SCIENTIFIC AMERICAN

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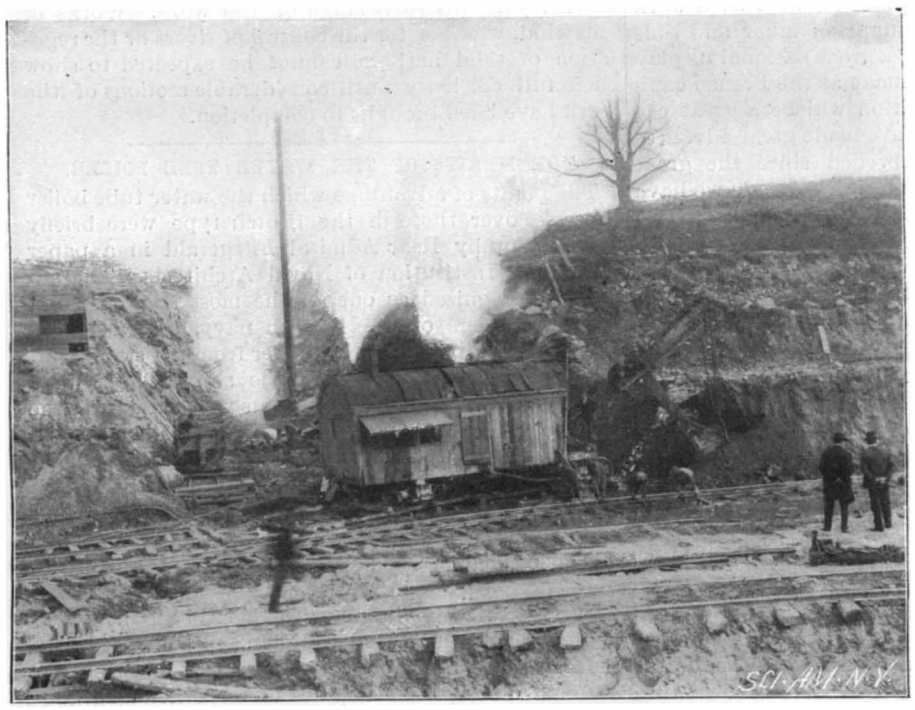
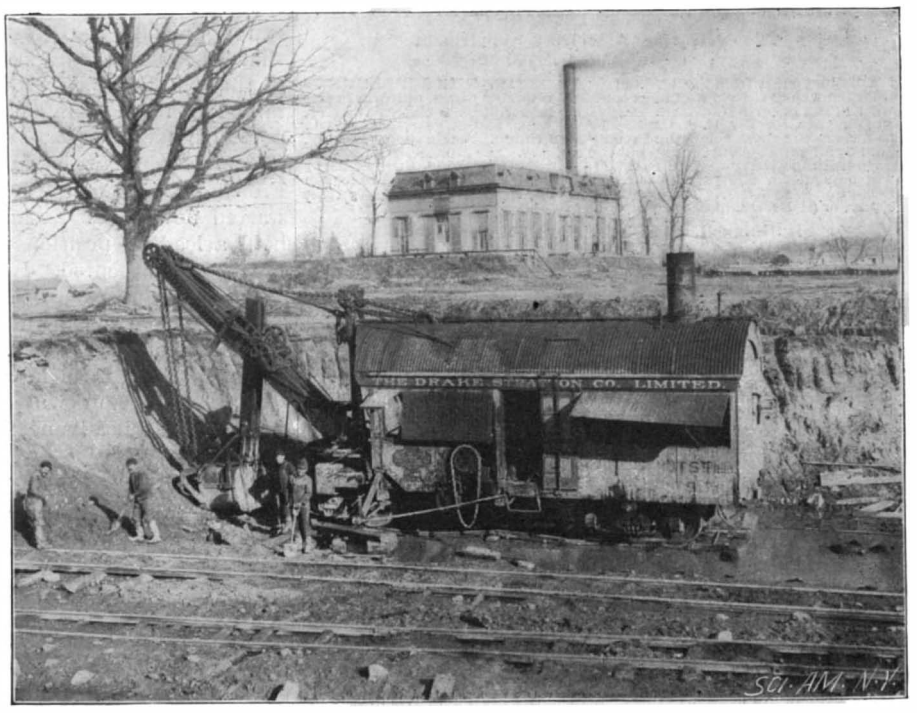


ROCK CUT NORTH OF THE GRAND STAND LOOKING WEST.



STEAM SHOVEL CUT AND CONTRACTOR'S POWER HOUSE, FORMERLY PART OF JEROME PARK CLUB HOUSE.

DOUBLE CONDUIT FOR CARRYING WATERS OF OLD AND NEW AQUEDUCTS INTO RESERVOIR. BOTTOM OF EXCAVATIONS IS AT LEVEL OF FINISHED FLOOR OF RESERVOIR.

THE WATER SUPPLY OF NEW YORK CITY—JEROME PARK RESERVOIR.—[See page 314.]

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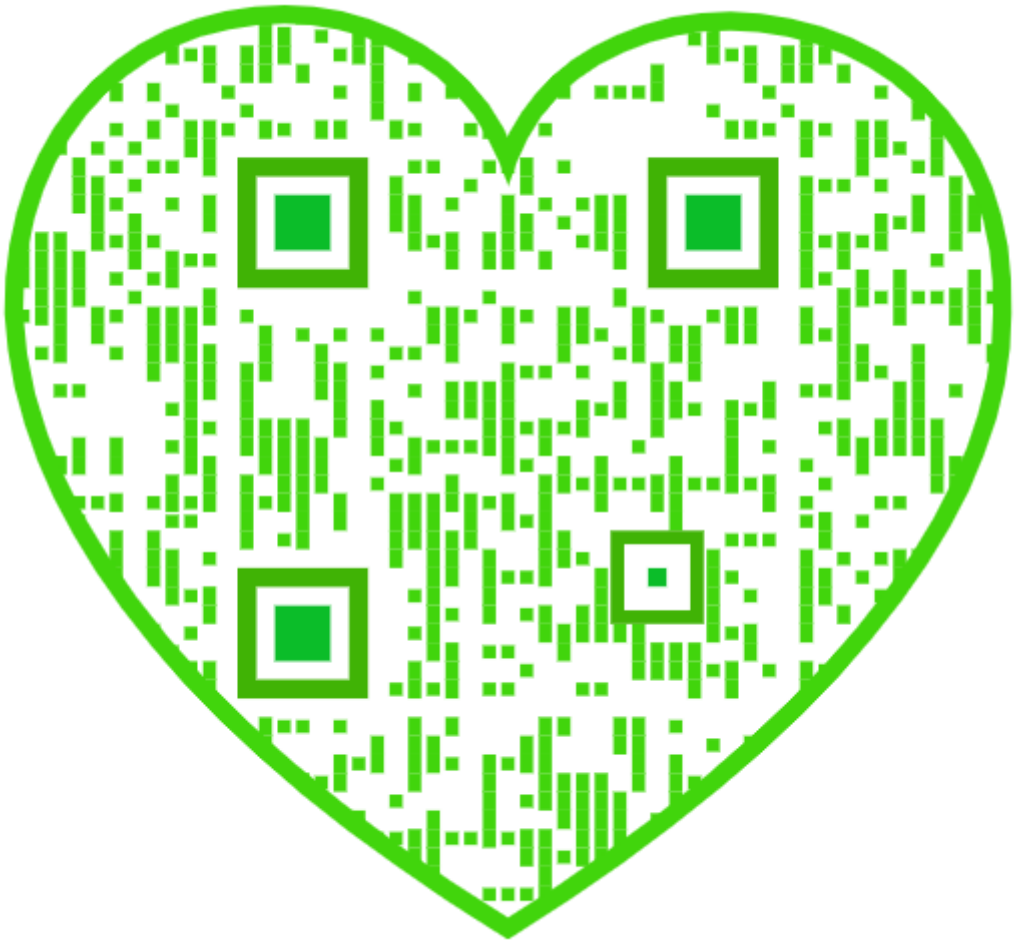

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THE UNITED STATES AND THE PARIS EXPOSITION.

It is to be hoped that Congress will take early action as the result of the President's message urging it to make provision for our adequate representation at the Paris exposition in 1900. The message recommends that such timely provision be made that our inventors and producers may have adequate opportunity to "fortify the important positions they have won in the world's competitive fields of discovery and industry."

It is certainly advisable that action should be taken during the present session, inasmuch as a delay of a whole year, at a time when other nations are making such special efforts is liable to result, among other disadvantages, in our securing an insufficient allotment of space. No one who is unacquainted with such work can appreciate the great amount of labor and time that is necessary in organizing a great national display of the kind that we ought to make at the French capital. The forthcoming exhibition will be a great opportunity for America. We have made great advances in the years that have intervened since the great French exposition of 1889. In a single decade we have started new industries and so developed them that we hold a leading position where but a few years ago we were not represented. In older industries, such as the manufacture of steel, we lead the world; and invention has never been so fruitful in our midst as in this closing decade of the century. The outside world is cognizant of these facts in a vague way, and the forthcoming exposition will give us an opportunity to demonstrate our advancement in a concrete and practical form.

SHADE TREES FOR THE STREETS OF NEW YORK.

We note that the Tree Planting Association has opened offices at Nos. 64 and 66 White Street, New York City. Its aim is to beautify the city by encouraging the planting of shade trees on each side of the streets, and it is endeavoring to start the movement by persuading property holders on Fifth Avenue to plant trees in front of their houses. The aims of the association are in every way praiseworthy, and there is no conceivable way in which the "wilderness of streets" which is found in many parts of the metropolis could be so cheaply beautified and relieved of its monotony as by lining the curb of the sidewalks with suitable shade trees. Many of the side streets which lead up to Central Park on the east and west are rendered extremely handsome by the costly and artistic houses which they contain; but they all have a certain air of coldness or formality which would be largely dispelled by the presence of an avenue of trees.

BRITISH INTEREST IN THE NICARAGUA CANAL.

The editor of Engineering, who is well known for his fairminded and courteous attitude toward this country in everything relating to American engineering and industry, states that it is a mistake to suppose that Great Britain has any desire to build and own the Nicaragua Canal because of its strategic value. He is of the opinion that the conditions are entirely different from those relating to the Suez Canal, where England's aim is simply to maintain neutrality. As a matter of fact, the strategic route to the East, where the United States is never likely to be a hostile power, does not lie through the Suez Canal, nor would it lie through the Nicaragua Canal. As a mere strategic route in time of war the Nicaragua Canal would never be worth the vast sum of money that it would cost; for it would be entirely in foreign territory, and would be "at the mercy of a small hostile republic or of a collier blocking the waterway."

THE MISSISSIPPI FLOODS.

The calamitous floods which have again laid waste the lower Mississippi Valley have brought forth a vast amount of correspondence and suggestion as to the best way to control the great river and keep it within its banks. As is usual, the majority of the critics betray a complete ignorance of the magnitude of the problem and the cost of carrying it out in its entirety. One of the leading morning papers of New York has criticised the methods of the engineers to the extent of stating that the crevasses which have been formed in the embankments prove that as a system of protection the levees are a failure; and the writer goes on to condemn the whole system as such, and characterizes the outlay as a waste of public money. The obvious reply to such critics is to ask them what they would substitute in place of levees and revetment. As a matter of fact, the present methods are the result of long experience and a careful study of the problem by skilled engineers. The problem of the control of rivers which are subject to heavy floods is at any time extremely perplexing, and it is rendered doubly so in the case of the Mississippi on account of the enormous amount of silt which it carries down. Wherever the river broadens out into shoals, and the rapidity of its flow, and therefore its transporting power, is reduced, this silt is deposited and the available depth between the banks is reduced. The only possible way to prevent an overflow at the next flood is to scour out this deposited silt, or to raise the height of the adjoining banks, or both. This can be accomplished by building wing dams, cut-offs, etc., and protecting the banks by revetment and building artificial levees. The work of this kind which has been already carried out has rendered effective service, not merely in the Mississippi Valley, but along the course of other rivers that are subject to overflow. Because at certain points it has failed to stand the supreme test of the past few weeks, it is folly to condemn the whole system for all time. Compared with the whole scheme of improvement aimed at by the Mississippi River Commission, the work which has been done thus far has been fragmentary, and, to a certain extent, experimental, and it is absurd to condemn it for lack of efficiency at this early stage of the work. Works of this kind, whether for the control of rivers or the regulation of tidal harbors, cannot be expected to show their full efficiency until considerable sections of the work have been brought to completion.

THE MERITS OF THE WATER TUBE BOILER.

The points of advantage which the water tube boiler possesses over those of the Scotch type were briefly summed up by Rear Admiral Fitzgerald in a paper before the Institution of Naval Architects. The admiral is recognized as one of the most advanced and practical officers of the English navy, and his paper gave the good points of the boiler from the standpoint of the man who has to fight the ship. The type of boiler upon which the observations were based was the Belleville, and the experience was that gained on the Powerful and Terrible and on the smaller range of experiments carried out on two or three gunboats. The points of superiority are: 1. Ability to raise steam rapidly. The Sharpshooter, a gunboat of 735 tons displacement, has raised steam in twenty minutes from "fires out" and cold water. She would have taken from two to three hours with her old boilers. 2. Ability to make large and rapid increase of speed, and also large and rapid reductions without blowing off. With a Scotch boiler a ship has to be worked up gradually to full speed; but with water tube boilers even a large ship can start off almost like a torpedo boat. 3. Comparative safety. The risk from scalding in the event of a shell penetrating the boiler room is far less. Each of the water tube boilers of the Powerful holds only a ton of water; but each boiler of the Majestic holds 22 tons. 4. Facility for examination, cleaning, and repairs. Unlike the Scotch boilers, these can be cooled with great rapidity without any danger of injury, in order that they may be examined, cleaned, and if necessary, repaired. In the Scotch boiler such rapid cooling would involve leaky seams and tube plates. 5. Saving of weight. The weight of the boilers, uptakes, etc., of the Powerful for 25,000 horse power, with natural draught, is only 1,164 tons. If she had been fitted with Scotch boilers, it would have been about 1,862 tons—a saving of nearly 700 tons, or about 40 per cent.

THE AMERICAN LOCOMOTIVE EXPORT TRADE.

There is perhaps no branch of foreign trade in which the United States have won a more speedy recognition than in the locomotive industry. It is not many years ago that the foreign locomotive trade was almost entirely in the hands of European manufacturers, and the American locomotive was an unknown quantity outside of the United States. The causes were not far to seek. In the first place, the large colonial interests of the European nations brought them into close contact with foreign states and peoples, who had the opportunity to see the European locomotive at work, as it were, at their very doors. On the other hand, the development of the railroad system of this country was so extraordinarily rapid, and produced such an enormous demand for locomotives, that our manufacturers were fully occupied in supplying the home market. Of late years, however, the rate of railroad construction has been steadily reduced; the older roads have become thoroughly equipped with modern and more powerful locomotives and the demand for new stock has shown a relative decline.

One natural result of this has been to cause our builders to give increasing attention to the foreign market, and a very successful attempt has been made to introduce the American locomotive in those countries which have hitherto been exclusively controlled by European builders. Our success has been greatly assisted by the fact that the American built machine is specially adapted to the requirements of foreign railroads. It is strong in those points in which the other type is weak. The European locomotive has always suffered from a certain rigidity which, while it has no particularly bad effect on the comparatively level and straight lines which are found on the railways of the old world, has proved to be positively disastrous when these machines came to be run on the sharp curves and more or less loosely constructed tracks of some of the foreign and colonial railways.

Now, it is a fortunate fact that the circumstances which caused the earlier roads of the United States to be built on a rather rough and ready plan, with light rails, sharp curves, and heavy grades, produced a type

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of locomotive specially adapted to meet these conditions—a type with such marked characteristics and with such all around efficiency that it is known the world over as distinctively the American locomotive. The merit of the type consists in the simplicity and accessibility of its parts, its great flexibility, by which it is enabled to adjust itself to the unevenness of the track, its large boiler power, and lastly, the large hauling power which it has always shown.

Now it can be seen that these qualities are admirably adapted to the requirements of foreign railroads, and our locomotives have always secured favorable comment from those companies which have used them side by side with locomotives of European design, and they have never, as far as we know, failed to obtain a secure hold on the trade.

In response to our inquiry we are informed by a leading firm in this country that while for the past two or three years the export trade in the aggregate has not been as large as in the few years preceding, there are signs that it is again on the increase. This falling off was not due so much to any relative decline in this trade as compared with the export trade of the country in general, but is attributed to the general depression which has marked the trade of the world at large. As a matter of fact American locomotive builders are just now receiving inquiries from more foreign countries than ever before in the history of the trade.

THE TRAGEDY AT THE CHARITY BAZAR, PARIS.

There have been few catastrophes of late years that have been more shocking than the burning of the Charity Bazar building in Paris, by which nearly one hundred and fifty people, most of them ladies of high social position, were burned to death in the space of a few minutes before the eyes of a multitude of people who were powerless to help them.

The Grand Bazar de Charité is held by the chief charitable institutions of the city, which unite every year for the purpose of selling articles for the relief of the poor. The Bazar was held under the patronage of the leaders of society, and many of the stall holders were ladies of rank. The temporary building in which it took place was a one-story affair 200 feet wide by 300 feet long, and the interior had been laid out to represent a street in mediæval Paris. The booths were representations of the ancient shops and house fronts, and they were made of linen painted over with turpentine and filled between the surfaces with papier maché. This material was old, having been used in the previous year in the neighboring Palace of Industry, and it had just been repainted. The building itself was of the flimsiest description, and highly inflammable. The walls consisted of ¾ inch boarding, and the roof apparently was covered with tarred felt and was carried upon vertical posts. The wooden floor was a few feet above the ground, and there was only one exit that seems to have been at all familiar to the ill-fated crowd of 1,500 souls within.

All things considered, it would be difficult to imagine a more fatal "fire trap" than this, and as the sequel showed, it was to prove terribly effective. The fire is supposed to have been caused by the illuminating lamp of a kinematograph, and it spread with unusual rapidity, a New York lady, who was rescued, describing the flames as traveling along the flimsy roof with a rapidity "just like that which one would see if a sheet of paper were to be saturated with petroleum and then ignited." The same eye witness says the ceiling, being in flames, kept constantly dropping in small pieces, and these burning pieces falling on the ladies' hats and shoulders enveloped them in flames. Not only was this so, but the falling pieces of burning ceiling ignited the sides of the bazar, and soon a screaming crowd of women was running like so many poor creatures in a burning cage, with fire descending on them and fire on all sides of them like great walls of flame.

There was the usual crush at the entrance, and when the building was yet partly filled, the burning ceiling fell bodily in upon the huddled mass and brought them speedier death.

The tragedy has taught the world another lesson as to the frightful risk that is run whenever these temporary matchbox buildings are put up for bazar or exhibition purposes. This structure was undoubtedly more dangerous, and built with less regard to fire risk, than the average building of the kind; but it is certain that even in such costly erections as are put up for the international expositions, the dangers of a conflagration are exceedingly great. We all remember in what a short space of time the cold storage building at the Chicago Exposition was swept out of existence, and not all the costly steel and stucco work of the other World's Fair buildings saved them from being wiped out with equal suddenness.

Of course, it would be impossible for such a building as the Charity Bazar building in Paris to be put up in a city like New York as long as the building laws were literally interpreted and rigidly enforced; but, unfortunately, there is always a disposition to leniency when the question comes up of erecting the large shed structures which are used for skating rinks, bazars or for charitable purposes. The fact that a building is to be temporary does not diminish the risk of its daily use, and should never be allowed to affect the question of its being made reasonably fireproof, with ample means of exit in cases of emergency.

THE NEW TWIN SCREW PASSENGER SHIPS OF THE NORTH GERMAN LLOYD COMPANY.

The North German Lloyd has built and put into commission, since 1892, twenty-three large transatlantic steamships, and during the present season will place in service between New York and Bremen six magnificent new twin screw ships. One of these, the Kaiser Wilhelm der Grosse, the largest steamship in the world, 649 feet long and with a tonnage of 14,000 and a displacement of 20,000 tons, sails on her initial trip to New York, September 14. The sister ship, Kaiser Friedrich, will be placed on the route shortly after. Four of the six new ships enter what is termed "The Twin Screw Passenger Service of the North German Lloyd." These, the Friedrich der Grosse, Barbarossa, Koenigin Luise and Bremen, are each 10,600 tons register, with 7,000 horse power, and have a total length of 550 feet and a breadth of 60 feet.

The Friedrich der Grosse has already made her initial trip to New York. The Koenigin Luise sails on her first outward passage May 13, the Barbarossa on June 10, and the Bremen on June 24.

Each of these ships has four steel decks in addition to the double bottom covering their entire length. Transversely they are divided into thirteen watertight compartments extending all the way to the upper deck, and it has been satisfactorily demonstrated that two of these may be filled without endangering the safety of the ships. The horse power required to drive the twin screws which propel these ships is generated by two quadruple expansion engines on four cranks, the engines being balanced on the principles of the Schlick patents.

The architecture of the passenger steamships is quite unique, in that a large proportion of the space devoted to passenger accommodations is in a high superstructure amidships, 256 feet in length, and practically containing three stories. This gives the ships a distinguishing appearance from any others now in service, and allows for two spacious promenade decks, one above the other, each extending 256 feet, the full length of the superstructure, with passageways across from one side to the other.

The passenger accommodations on these steamships are very luxurious and complete, the woodwork being in ivory tint and broken with many panels, and the side walls and ceilings containing exquisite examples in modern art done in oil by German artists of recognized reputations. There is a large glass cupola or dome crowning the center of the ceiling of the dining saloons, which insures a flood of soft light. These passenger steamships are enormous freight carriers and are not designed for speed, but to meet the requirements of those who wish to enjoy the ocean voyage and the superior accommodations rather than to merely save time in crossing the ocean in the shortest possible period.

The two monster ships of the fleet, the Kaiser Wilhelm der Grosse and Kaiser Friedrich, have been constructed with reference not only to a large passenger carrying capacity, but for very high speed.

It may be reasonably said that the North German Lloyd has successfully worked out the evolution of an ocean fleet, and its record for new steamships is one of which it may justly be proud.

THE RETURN OF MR. DE WINDT.

Mr. Harry de Windt has recently returned to London from the Siberian shores of Bering Strait. In a short time he will leave England for a lecturing tour in the United States. It is said he was brutally treated by the Tchuktchis at Oumwaidjik. In consequence of this the United States government will, it is said, send a vessel to Oumwaidjik to punish the chief. The Tchuktchis are nominally Russian subjects; the only vessels ever in the neighborhood are American whalers and the United States revenue cutter. Mr. De Windt had an enforced sojourn of two months among the natives. He gave the following information concerning them to a representative of Reuter's agency:

They are physically a far finer race than the Alaskan Eskimo races, and their women are better looking, but the Tchuktchis are wholly devoid of morality, and will barter a wife for a handful of tobacco. Infidelity is no crime among them. They number altogether about 5,000, and along Bering Strait are seven settlements of perhaps 300 each. The others are scattered along the seaboard of the Arctic Ocean, stretching away to the settlement of Nijni Kolymsk. They acknowledge no government and pay no taxes. None of them had ever even heard of the Czar. At a village not ten miles from Oumwaidjik the language was totally different, and the natives of each settlement are unable to understand each other. Oumwaidjik itself is described as one of the most desolate spots in creation. There is not a tree or blade of grass for 400 miles inland, nothing but swamp and rock. The natives died weekly of starvation and scurvy, and often took to devouring raw seaweed. The most weird Tchuktchi ceremony is the "Kamitsk." This is simply the putting to death, with their free consent, of aged or useless members of the community. When a Tchuktchi's powers have decreased to an appreciable extent, a family council is held and a day fixed for the victim's departure for another world. Perhaps the most curious feature is the indifference shown by the doomed one, who takes a lively interest in the proceedings, and often assists in the preparations for his own death. The execution is preceded by a feast where seal and walrus meat are greedily devoured and villainous whisky is consumed.

THE POSTAL CONGRESS.

The Universal Postal Union of the world holds meetings at intervals of six years. The fifth of these conventions began at Washington, D. C., on May 5. This is the fifth convention which has been held by the Postal Union. It is attended by delegates from more than sixty countries and provinces and it is thought that the three countries which are now out of the pale of the Postal Union may possibly all be admitted to the union before the congress has finished its labors. So much of the business of the world is now done through the medium of the mails that the meetings of the union are of extraordinary importance. It is the first meeting of the kind which has ever been held in America, and the rules and regulations which are made will stay good until the year 1903. The congress is held in the old building of the Corcoran Art Gallery, and the proceedings are conducted in the French language. All of the business to be transacted by the congress will be first considered by committees, which will be five in number. Among the important amendments to existing regulations governing the union which will probably come up is a proposal to raise the limit of weight on letters which may be transmitted to foreign countries for postage equivalent to five cents. The present weight of half an ounce is considered too low, and the limit may be increased to three-quarters or even one ounce. The increase of weight implies greater expense of transportation, but not for handling and for clerical work. The parcels post, money orders, the compensation due the countries over which mails are carried to regions beyond, and the proposed universal international stamp, are other subjects to be discussed at this gathering of delegates. It is also hoped to arrange for the adjustment of rates charged by the different countries on a simple basis and technical matters of special interest to officials superintending the work at the Berne office, which acts as a clearing house for the Universal Postal Union.

AERONAUTICS AT THE TENNESSEE CENTENNIAL EXHIBITION.

The air ship or dirigible balloon has achieved another successful flight, this time in connection with the Centennial Exhibition at Nashville, Tennessee. Prof. N. W. Barnard, director of physical training of the Young Men's Christian Association, Nashville, has been engaged for some time in the construction of an air ship which depends for its buoyancy upon a gas inflated balloon and is driven by a single propeller. The balloon is approximately egg shaped in form, measuring 20 feet in diameter and 46 feet in length, and moves in the direction of its longer axis. The usual basket attachment is replaced by a light framework in which the operator sits and controls the mechanism. This consists of a driving axle and pedals which are geared to a propeller shaft that extends 20 feet in front of the machine and carries a propeller of very light construction. On each side of the body of the ship is arranged a kite-shaped sail about 2 feet wide by 3 feet long; and these are controllable by means of levers placed conveniently to the operator. The ship was started a little before noon and rose to an estimated altitude of about half a mile and moved rapidly to the westward. The descent was made about 12 miles from the Exposition grounds, and Prof. Barnard, who returned the same night to the city, expressed himself as well satisfied with the success of the trial trip.

THE LONGEST BRIDGES.

The longest bridge in the world is that over the Tay, in Scotland, which is 3,200 meters = 9,696 feet long; and the next longest is also in Great Britain, being that over the Firth of Forth, 2,394 meters = 5,552 feet in length. The following table gives, in meters and in feet, the lengths of the principal bridges in various countries:

	Meters.	Feet.
Tay, Great Britain	3,200	9.696
Forth, Great Britain	2,394	5,552
Moerdyck, Holland	1,470	4,820
Volga, Russia	1,438	4,715
Weichsel, Germany	1,325	4,346
Thoen, Germany	1,272	4,172
Grandenz (Elbe), Germany	1,092	3,580
Brooklyn, United States	488	1,601

The greatest single span of the Forth Bridge is 521 meters = 1,725 feet; of the Elbe Bridge, 420 meters = 1,378 feet; of the East River Bridge, 488 meters = 1,610 feet.

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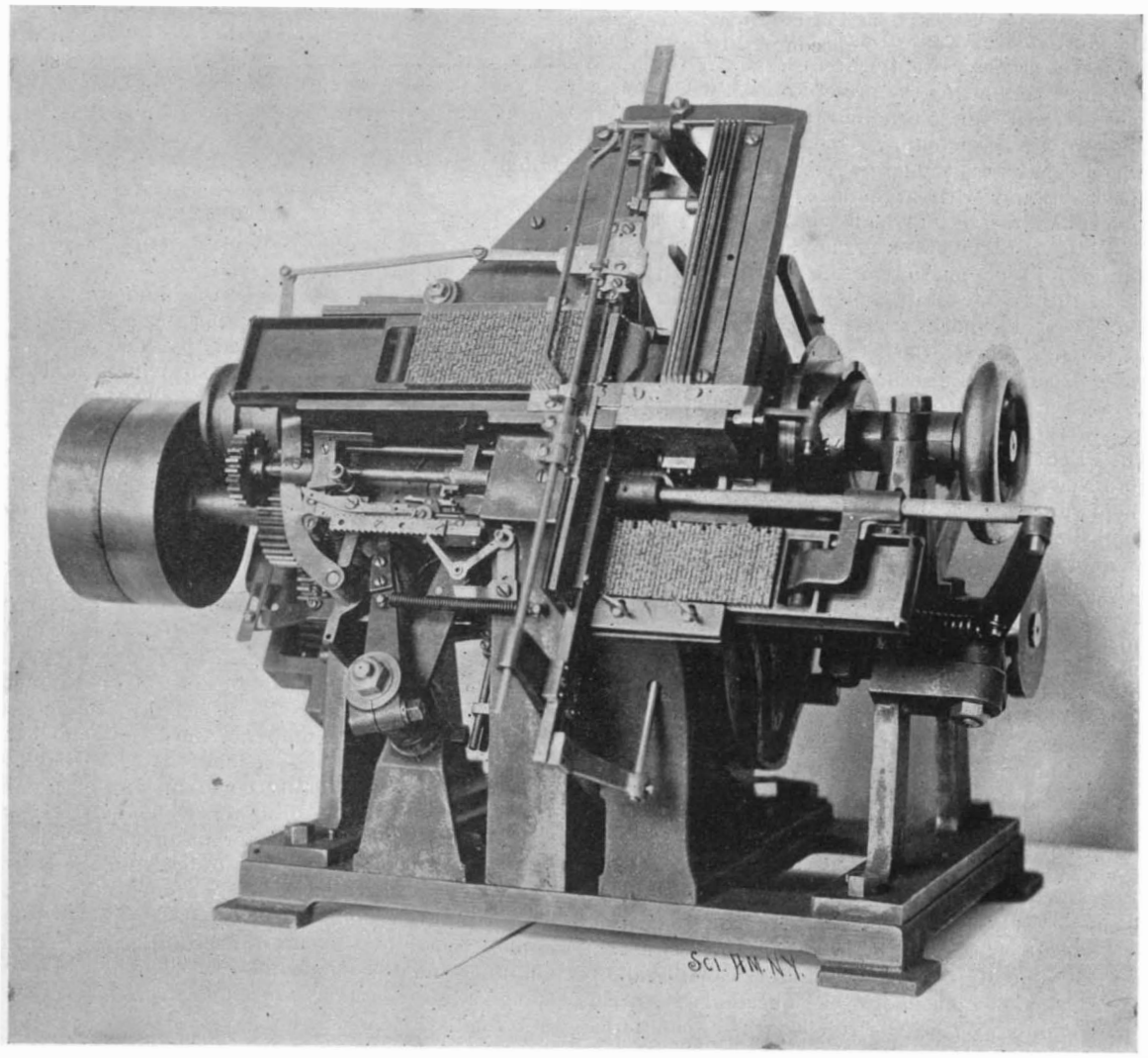
A PRINTERS' TYPE JUSTIFYING MACHINE.

The highly ingenious machine shown in the accompanying illustration automatically lifts lines of type from a galley and justifies them, the exactly spaced lines being deposited on a second galley, and the machine doing its work without any assistance whatever, beyond the putting on and taking off of the galleys containing the columns of matter. The machine is a recent invention of B. M. Des Jardins, of Hartford, Conn. The matter as presented to the machine is assumed to have been corrected and revised, and as it is well known that in the most careful book composition there are many corrections and revisions and rerevisions, for each of which there is the additional labor of justification, it is expected that this machine will find a practical field in such work, as well as in the justification of matter from type-setting machines which set up the type in a continuous line, requiring a special hand to do the work of spacing. In the type set up for this justifying machine the words are separated by strips of brass, which aid the machine in locating the positions of the spaces, and the lines are held apart by thin rules to protect the loose, uneven ends. A reciprocating ratchet rod operating a traveling block automatically feeds the column leftward, a line at a time, into the justifying mechanism, which is located in the middle of the machine. The first line is then lifted under a clamping bar which supports the dividend member of a mechanical computing instrument and at the same time the separating rule is removed. This dividend member acts in conjunction with a bar which records the number of places requiring spaces, and the combined position of the two determines which sizes are wanted. This division gives the first step toward the full result sought for. Three sizes of spaces are employed, which are respectively eighteen, twenty-four, and thirty one-thousandths of an inch in thickness. These are combined to make other sizes, all of which differ from each other by the same amount. Whenever the instrument's division gives a result between any of the regular sizes, it indicates the nearest smaller one and records the remainder in such a way as to cause the machine, at the required time, to shift the action to the next larger space, thereby indicating a proper combination of two sizes. The setting of the computing instrument just described occupies only the fraction of a second of time, and that is followed by another motion of the line upward, into a channel which leads directly to the receiving galley. The line is then pushed along this channel intermittently, being intercepted by the brass strips opposite the space collecting and transferring device. The latter is located below the end of the reservoir channels, and is controlled by the computing instrument. It is made to collect out of one or more of the three channels such spaces as are needed to build up the required thicknesses; and the instrument also causes the space collector to change sizes in time to use enough of the larger ones to fill out the line correctly. The transferring device also removes the original brass spaces from between the words, and inserts the new ones in their places. Upon the disposal of the last word, another action of the computing instrument starts the discharging mechanism, and the channel which now contains the line is caused to collapse and deposit its charge on the receiving galley, to the left, accurately justified.

In properly proportioning his spaces, the printer calculates by the eye, as best he can, the spaces required between the words of a line, and the greater the accuracy required the more time will be consumed in justification, but this machine secures absolute, mathematical accuracy, such as is demanded in the best work, and leaves no room for carelessness or bad judgment.



THE DES JARDINS TYPE JUSTIFYING MACHINE.

THE KENSINGTON BICYCLE.

The modern bicycle has been brought to such a state of perfection as a piece of machinery that any improvements in it at the present day are of greater interest than ever before, as indicating a still further approach to what may be not rashly termed mechanical perfection. In the cut we present illustrations of some of the features of the Kensington bicycle, which certainly show a most interesting development in the art of cycle building.

Referring to Fig. 1, which gives a section of the crank bracket, we find it shown with a cylindrical body into whose ends are screwed the ball races. The balls are retained in these by retainers shown in section. The sprocket wheel spider is brazed upon the crank shaft and is turned with a recess so as to extend over the edge of the cylinder. Directly against the spider is butted the right hand cone. This makes the sprocket side practically dustproof. The other side of the bracket is treated in much the same way, except that here the adjusting cone is threaded on the axle and is provided with lock nuts and washers, while outside of all is a dust cap also lapping over the bracket, thus securing the dustproof feature for this side also.

The oiling tubes of the crank bracket are a peculiarly happy device, being so arranged that the oil reaches the balls—something one can rarely be sure of in the ordinary type of crank bracket. It should also be mentioned that the cranks and shaft are all in one piece and that the sprocket is secured by four bolts to the spider, the spider being screwed on to the shaft and brazed.

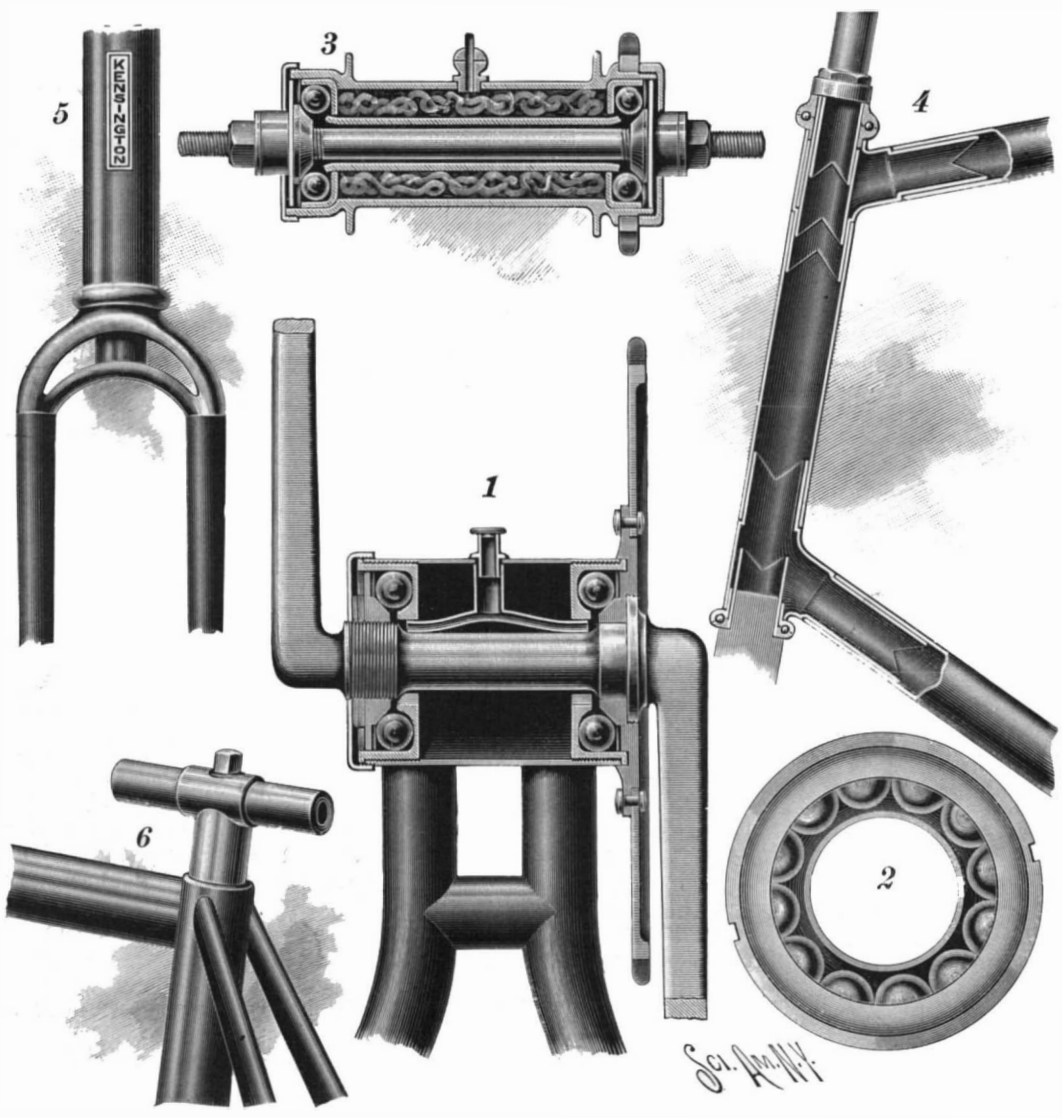
The cranks are square in section, it being considered that both their strength and appearance are improved by the adoption of this section.

As an example of a ball race, Fig. 2 is given, showing a front view of the ball retainers.

In Fig. 3 the hub of the driving wheel is shown. Here will be seen the same dustproof construction carried out on the lines explained with reference to the crank bracket. The interior of the hub is packed with waste or lamp wick and communicates by small openings with the ball races. A single oiling answers for the whole season.

What the manufacturers term their flush joint connection forms a very interesting and valuable feature, and is illustrated in some detail in Fig. 4. By studying the illustration it will be observed that where the connections enter the tubing they are recessed, so that the tubing telescopes over the diminished portion and butts against the shoulder. This gives a perfectly flush joint, and after brazing, a most secure one. It will be observed how this principle is carried out in the different joints of the head as shown in Fig. 4, and this head may be accepted as an exponent of the system as applied to all other parts of the frame.

In Fig. 5 is shown the very characteristic fork crown, on which there has been granted a patent. This is an



NOVEL DETAILS OF THE KENSINGTON BICYCLE.

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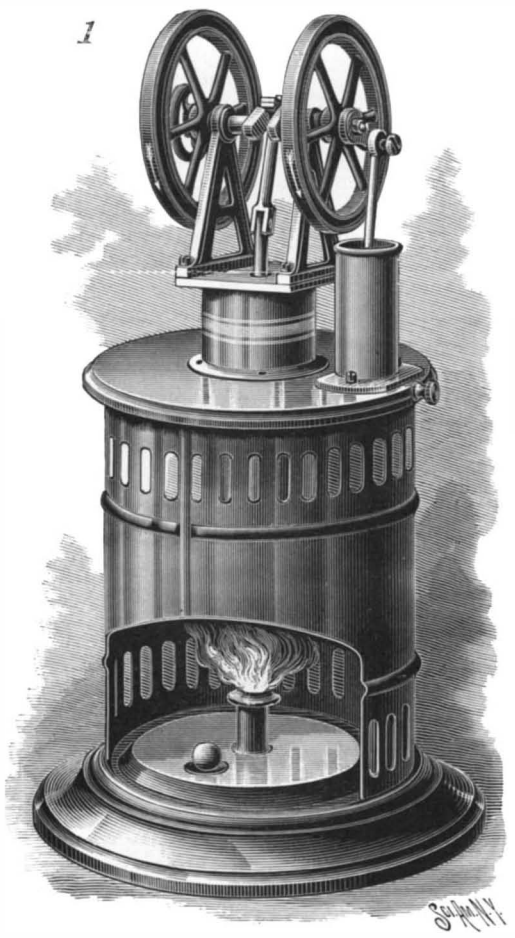
oval crown, a contour which has proved very popular with the public. The tendency of the day being toward double crowns, the manufacturers of the wheel have designed a double oval fork crown which is a solid one piece drop forging, and is therefore naturally of great strength, while the distribution of the material into two arcs of different radii introduces the truss element at least for some of the strains. Independent of its utility, the double oval crown certainly constitutes



SMALL CALORIC ENGINE.

a very characteristic and handsome feature of the wheel.

A good example of how the flush joint is carried out and with what neat effects may be seen in Fig. 6. Here we have a boltless connection at the head of the center brace, with flush jointed rear stays. At first sight, it might seem a mystery how the saddle post is held in shape. The bolt head seen on top of the saddle post explains it. By turning this in one direction, a taper plug is drawn up into the lower end of the seat post, expanding it against the walls of the tube and fixing the seat post in position. By turning the bolt in the opposite direction the cone is forced downward, leaving the seat post free for adjustment. Nothing can be neater or more efficacious than this substitute for the old time cross bolt, which has so often been a source of annoyance.

With the many special and exclusive features the Kensington is regarded as one of the leaders in high grade cycle circles of to-day.

The Kensington bicycle is manufactured by the Martin & Gibson Manufacturing Company, of Buffalo, N. Y.

TWELVE WHEELED AMERICAN LOCOMOTIVE FOR THE BRAZIL RAILWAY.

Reference is made elsewhere in our columns to the trade with foreign countries in American locomotives; a trade which there is reason to believe is yet in its infancy, and will assist in the future to keep in full employment those vast establishments which have supplied the motive power to the 180,000 miles of railroad which form the system of this country.

The accompanying illustration shows a powerful locomotive of the Mastodon type, which has recently been built by the Brooks Locomotive Works, of Dunkirk, N. Y., for Estrada de Ferro Central do Brazil (Brazil Central Railway). This company is one of the leading American exporters of locomotives, and, in addition to its trade with the Spanish American states, it has recently made shipments to Japan, a country which of late has shown a disposition to make increasing use of American locomotives.

The subject of our illustration is a twelve wheeled freight locomotive, with cylinders 21 inches in diameter by 26 inches stroke. There are 8 coupled drivers, loaded to 142,000 pounds, and a leading truck carrying 28,000 pounds. The weight of the tender is 82,000 pounds, the total weight of engine and tender, in working order, being 252,000 pounds.

The boiler is of the Belpaire pattern, and is 5 feet 8 inches in diameter, the fire box being 38½ inches wide by 114 inches in length. There are 248 flues, 2¼ inches in diameter by 13 feet 10½ inches in length. There are 209 square feet of heating surface in the fire box and 1,991 square feet in the tubes, or a total of 2,200 square feet. The grate area is 29 3/10 square feet, and the boiler pressure is 180 pounds.

Water is fed to the boiler by injectors and by feed pumps worked from the crossheads. With few exceptions, this handsome locomotive conforms to the standard American Mastodon type, the chief difference being in the width of the gage, 5 feet 3 inches, and the use of a pair of buffers above the pilot and on the rear of the tender. Another peculiarity which will be noticed is the use of three headlights, two of which are located at the base of the smoke box.

The hauling capacity of these locomotives on a straight, level road, at 10 miles an hour, is about 5,073 tons, exclusive of the weight of the engine and tender.

A MINIATURE CALORIC ENGINE.

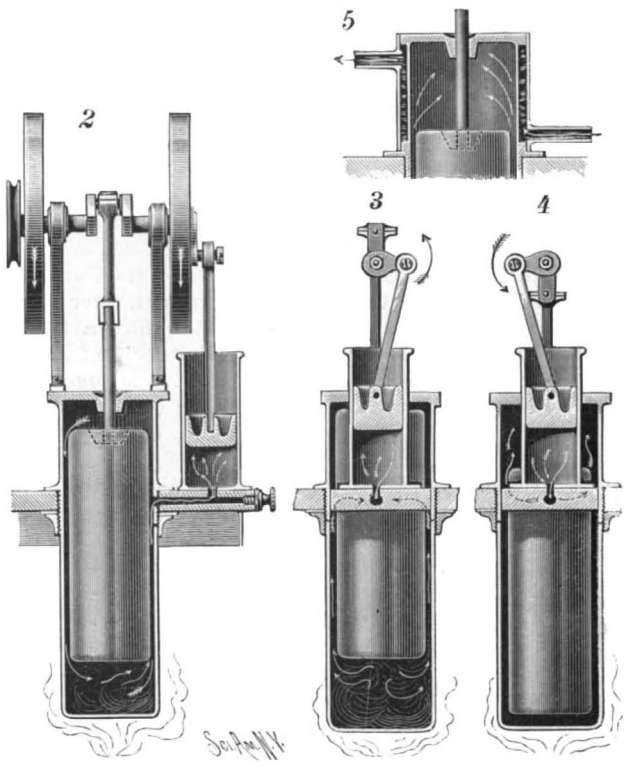
The hot air engine is not a very recent invention. A number of engines of this class, of different sizes, were devised and used in the early part of the present century, and in the latter part of the last century there were in existence engines constructed to be operated by the expansion of air.

Nothing in the way of a motor, aside from a windmill or water wheel, can be more simple than this, and it is a pity that it is not capable of more general application. Motors of this kind have been used to some extent for driving light machinery, and they have been largely employed in pumping water.

Quite recently caloric engines have been made in the form of a toy, as illustrated in the larger of our engravings. In the motor here shown, the air contained in the expansion cylinder is alternately heated and cooled, and no fresh air is introduced. This action is so rapid in a small engine that the crank shaft can make 600 or 700 revolutions a minute. By examining the sectional views (2, 3 and 4) a good idea of the construction and operation of the motor may be obtained. In brief, the larger and longer of the two cylinders (the expansion cylinder) contains a long hollow piston called the "transfer piston," which fits the cylinder very loosely. To this piston is attached a rod extending through a close fitting sleeve in the top of the cylinder, the piston rod being provided with a connecting rod fitted to the crank at the middle of the shaft. The upper part of the expansion cylinder is furnished with a wide flange forming a cap which fits over the sheet iron fire box, and to the top of the expansion cylinder are secured the standards in which is journaled the crank shaft.

To the flange is attached the power cylinder, which is shorter and smaller in diameter than the expansion cylinder. This cylinder is provided with a piston to which is pivotally connected the lower end of a connecting rod, the upper end of which receives a crank pin projecting from one of the fly wheels at right angles to the transfer piston crank. A hole bored in the flange connects the expansion cylinder and the bottom of the power cylinder, as shown in Fig. 2, and the outer end of the hole is stopped by screw plug which can be removed for cleaning the hole, should it becomed stopped by oil or otherwise.

An alcohol lamp is provided for heating the expansion cylinder, it being placed in position to heat the lower end of the cylinder, as shown in the larger view. The top of the lamp is provided with a hemispherical cavity, at the bottom of which is the aperture for filling.

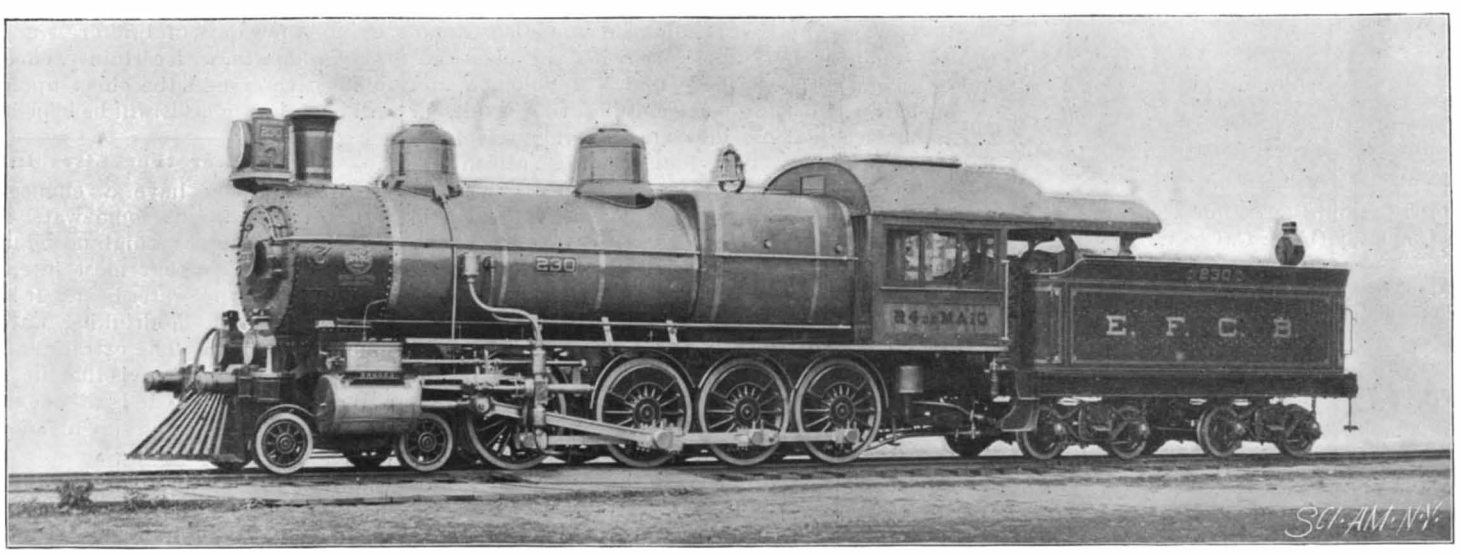


SECTIONAL VIEWS OF SMALL CALORIC ENGINE.

The stopper consists of a marble dropped into the hemispherical cavity and serving the double purpose of stopper and safety valve.

The expansion and power cylinders contain a certain amount of air which is never changed during the operation of the engine, except by expansion and contraction. Heat having been applied to the lower end of the expansion cylinder, the engine is started by giving the crank shaft one or two turns in the direction indicated by the arrows on the rims of the fly wheels. The air at the top of the expansion cylinder is transferred to the lower end of the cylinder by the transfer piston as it rises; at the same time the power piston descends, and by this time the air is heated in the lower part of the expansion cylinder and begins to expand. The power piston is in position to be pushed up by the air pressure. As the power piston reaches the upper end of its stroke, the transfer piston descends and transfers the heated air to the upper end of the expansion cylinder, where it is cooled, thus reducing the pressure and allowing the power piston to descend again. This operation is repeated at every stroke. It is almost impossible to believe that the air can be heated and cooled so rapidly.

The efficiency of the motor can be increased by surrounding the upper portion of the expansion cylinder by a water jacket provided with a water supply pipe at the bottom and a discharge pipe at the top, as shown in Fig. 5, and keeping a continual flow of cool



TWELVE WHEELED AMERICAN LOCOMOTIVE FOR THE BRAZIL CENTRAL RAILWAY.

Cylinders, 21 inches by 26 inches; diameter of boiler, 5 feet 8 inches; heating surface, 2,200 square feet; grate area, 29·3 square feet; diameter of drivers, 54 inches; weight of engine, 170,000 pounds; hauling capacity, 5,073 tons at ten miles an hour on level.

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water through the jacket. When the motor is used for pumping, the water is forced through the jacket.

This little motor is only a toy, but it very completely illustrates the principle of one of the most successful hot air engines ever devised. If the reader is mechanically inclined, he may make a motor on this plan on a much larger scale, and use it for driving machinery. There can be no doubt about its successful construction or operation, if it is made airtight and the bearings and friction surfaces are made to run free. The proportions may be about the same as shown in the cut.

The dimensions of the motor from which the views were made are as follows:

	Inches.
Length of expansion cylinder	4¾
Internal diameter of expansion cylinder	1 5/16
Length of transfer piston	2 1/16
Diameter of the transfer piston	1¼
Length of power cylinder	1¾
Diameter of power cylinder	3/4
Length of the cranks	7/16
Diameter of fly wheels	3
Height of firebox from base	5½

Recent Patent and Trade Mark Decisions.

Standard Cartridge Company v. Peters Cartridge Company (U. S. C. C. A., 7th Cir.), 77 Fed., 630.

Application to Circuit Court for Letters Patent.—Where the defeated applicant for a patent, after interference proceedings in the Patent Office, filed a bill in the circuit court for a patent, the decision of the Patent Office on the ground of priority is presumptively correct and the burden is on the complainant to establish his case by testimony which carries conviction.

Effect of Reduction to Practice.—Where the complainant was the first to conceive the invention and to give it such substantial expression that without further invention one can construct a machine embodying the invention, and he disclosed the same to the defendant, who appropriated the idea, it is then immaterial that the defendant made the first machine and filed the first application. Under such circumstances the defendant cannot avail himself of the complainant's neglect to push his conception to completion and promptly file an application. But, if ineffectual efforts were made to give the idea form in drawings, models or machines, and are abandoned before reaching such a stage of completion as to require only mechanical skill to carry the conception to success, the claim of priority cannot be sustained against a later independent conception carried into practical form at an earlier date.

What Kind of Conception Constitutes Invention.—The mere existence of an intellectual notion that a certain thing could be done, and, if done, might be of practical utility, does not furnish a basis for a patent or estop others from developing practically the same idea.

Burden of Proof in Interference Cases.—The burden is on the second reducer to practice to show prior conception by him and to establish the connection between that conception and his reduction to practice.

Proof of Due Diligence.—That may be accomplished by the exhibition of drawings and by oral explanations antedating the first reduction to practice by another. If the one who first conceived an idea of an improvement of an old machine by sketches showing so clearly the novel features of his improvement that a person could construct the improvement without exercising his inventive faculty, then such person is entitled to carry the date of his invention back to the date of the drawings. And it is not fatal if the drawings do not in all respects show the relation of the new parts to the old, nor exactly describe the mode of attachment, if the absent features are such as would be readily supplied by a mechanic.

Cartridge Loading Machines.—The Ligowsky patent, No. 464,883, has been held properly issued to him rather than to Charles S. Hisey.

Westinghouse Air Brake Company v. New York Air Brake Company (U. S. C. C., N. Y.), 75 Fed., 616.

Air Brakes.—The Westinghouse patents, Nos. 360,070 and 376,837, for fluid pressure automatic brakes, have been held valid and construed.

National Folding Box and Paper Company v. Stecher Lithograph Company (U. S. C. C., N. Y.), 77 Fed., 828.

Paper Box Machines.—The Munson patent, No. 259,416, for improvements in the manufacture of paper boxes consisting chiefly in the formation of the dies for cutting out and creasing the box blanks, that is in providing grooves in the counter die of the machine to co-operate with the embossing rules of the die for creasing the box blanks, is void for want of invention.

Olmsted v. A. H. Andrews Company (U. S. C. C. A., 7th Cir.), 77 Fed., 835.

What Constitutes Invention.—It is not invention to cause a device to work vertically that theretofore operated horizontally, nor to make a thing, such as a map case, neat and compact in form, light and attractive and so it can be handled and changed about without displacing the map within. The protection of the statute is granted for things invented, not for things produced. The latter belongs to the domain of mechanical skill only. Utility is not an infallible test of invention.

Acquiescence in Rejection of Claims.—The claims must be construed in the light of the proceedings in the Patent Office, and if the applicant has acquiesced in the rejection of any feature because it was old, or of any claim in which a certain thing was the essential feature, he cannot afterward claim what was thus rejected.

Map Case.—The Nutting patent, No. 343,060, is void for want of patentable invention over the prior art.

Boston's Gas Explosion.

The fire marshal of the city of Boston has made his report on his findings after a thorough investigation of the gas explosion of March 4, which caused ten deaths and injury to fifty persons. The fire marshal finds that the accident was due to the lax method of inspection pursued by the transit commission. Judge Ely, of the Municipal Court, has investigated the explosion. His decision holds that the Boston Gas Light Company was chiefly to blame for the disaster. Both decisions will be very important when the suits for damages come to trial. These suits will reach into the millions in the aggregate. Judge Ely, in reviewing the evidence, says:

"I find that the section 4 of the subway could have been built with safety under the requirements of the contract made for its construction with the Metropolitan Company, if proper precautions had been made.

"I find that the Boston Gas Light Company knew further that in the construction of the subway these pipes and mains were in constant danger; that if they left them to the care or carelessness of the contractor, and their men, they committed them to inexperienced hands, and that thereby great dangers constantly menaced the people."

In commenting upon the different phases of the accident and the contributory causes the judge says:

"The two broken gas mains had been in the ground and in use for 35 or possibly 40 years. They were cast horizontally, with the usual result of being of uneven thickness, the lowest part of the casting as it lay in the mould being the thickest part, and the casting gradually diminishing in thickness till it became thinnest at the highest part.

"At the first or westerly break in the 6 inch gas main, the good iron was only ⅛ inch thick at the thinnest part. Originally it had been about ¼ inch thick, but, either by reason of an old break, extending partly through the pipe, or other cause, the pipe had rusted half way through."

The fire marshal, however, says: "They (the transit commission) should have kept careful and incessant watch. The failure of the transit commission, holding as they did the strongest fiduciary relations to the public to adopt precautionary measures, seems to me, in the light of the evidence presented, to constitute inexcusable neglect on their part. Whether the legislative act creating the commission or the common law itself imposed any obligations upon the gas company with reference to the care of their pipes or not, it was the duty of the transit commission, it seems to me, to whom the public had the right to look for protection from subway dangers, to guard against such.

"I have been unable to learn that there had been any inspection of the pipes and their supports by the transit commission or their agents within twenty-four hours preceding the explosion."

Is Rhodesia Ophir?

The "Monomotapa," which forms the subject of Mr. A. Wilmot's new book, is the modern Rhodesia, says the London News. The work, to which Mr. Rider Haggard contributes a short introduction, has nothing to do with the Chartered Company. It ends with 1830, when the last Dominican monk left Monomotapa, and is entirely concerned with the identification of the land with the "Ophir" of Solomon and the ancient Phenicians. It contains the results of Mr. Wilmot's researches into such literary references to Monomotapa as are to be found in the Vatican and Lisbon libraries.

It is likely that Rhodesia will become a fruitful field for the archæological digger, as well as for the digger after gold. The archæologist Mr. Bent, who in 1891, after the occupation of Mashonaland, was one of the first modern Europeans to examine the wonderful ruins of Zimbabwe, has proved (to the satisfaction of most authorities) that these buildings were either by the Phenicians or by a people (Arabian) whose worship was the same as theirs. The most probable, though not the absolute, conclusion is held to be that Monomotapa was not only Phenician, but also that it was the Ophir mentioned in the Old Testament.

Mr. Wilmot has been able to prove that the Portuguese settlers of the sixteenth century had visited Zimbabwe, and that the place was then and for generations after occupied by the King of Monomotapa. In the seventeenth century the native population, from which the Mashonas of to-day are descended, was overrun by a savage, fierce race, which is now represented by the Matabele and other Zulu tribes. The new invaders are described as the Huns of South Africa. Portuguese civilization, such as it was, disappeared before them, and the very name of the old native kingdom was forgotten until the period of British expansion and exploration began.

The architecture and decoration of the Zimbabwe ruins are the same as those of Phenician remains in the Mediterranean islands and Asia Minor. Crucibles and other implements, ingots, specimens of art work in gold, discovered at Zimbabwe, indicate that the place was a Phenician gold mining settlement many centuries before the Christian era. It also seems clear that the cruel, hideous Baal worship of the Phenicians was established there.

From the Phenician age to the Portuguese the history of the country is a blank. But it is certain that Monomotapa was at all times regarded by Eastern nations as a land rich in gold. It is a dubious compliment to the English to call them, as Mr. Wilmot does, the modern Phenicians. Their ancient namesakes were as cruel a people as any known in history. The old Phenicians were great colonizers and explorers, they were the chief traders and carriers of the ancient world and the most adventurous seamen, but there, we hope, ends the resemblance between the English and the traders of Tyre, Sidon and Carthage.

Solomon's Ophir, if such it really was, became one of the fourteen missionary provinces of the sixteenth century Papacy. Under the Dominicans who succeeded the Jesuits in Ophir, the country was named "the province of the rosary." The story of the martyrdom of the Jesuit Father Silveira, in 1561, as related by Mr. Wilmot bears in some respects a striking likness to the Platonic description of Socrates' death. The volume contains some illustrations of Phenician remains and a copy of a fine map in the Vatican library. In this map, first published in 1623, Monomotapa is well filled up, probably from details supplied by the Roman missionaries.

The Prevalence of Sleeplessness.

It is probable that most medical men, whose work lies largely among those who toil with their brains, have noticed the unusual prevalence of sleeplessness during the past winter, and more especially among men. Patient after patient repeats the same story. He goes to bed at his usual hour, falls off to sleep very much as usual, but, instead of sleeping through the whole night until six or seven in the morning, he wakes about three, or even earlier, and, do what he will, he can get "no sound sleep after that time." He may lie more or less still, and may even "doze off" occasionally; but if he does, he dreams or is more than half conscious, and in the morning when it is time to rise he feels not only unrefreshed, but as if he would give all his day's profits for one single hour of sound, refreshing sleep. But that may not be. Now, there are three things to be said on this point—first, something as to the cause; secondly, as to the treatment to be avoided; and thirdly, as to the treatment which will probably cure. The cause is, no doubt, the absence of clear, bright, frosty weather, and the prevalence of a damp, relaxing atmosphere of relatively high temperature for the season. That this is the true cause is practically proved by the improved sleep which most patients obtained during the sharp frosty nights of the past winter. Under the circumstances what is to be done? One thing must certainly not be done—soporifics must not be resorted to. The right thing to do is, if possible, to diminish, or altogether stop, excessive brain activity. The most effectual step toward this end is to run away to the seaside for a few days or a week, and to a cold, bracing place. To take sleep-producing remedies may answer the purpose for a short time; but such a course cannot but be attended with after injury under the peculiar physiological conditions. A few days of brain rest and brain bracing at the seaside will, with certainty, effect a "natural" cure in most cases, and the effect upon the whole system will be as lasting as it will be beneficial.—Hospital.

A Bear that Lives in Water.

Next time you have a chance, recommends the Chicago Record, put some water from the edge of a standing pond under a high power microscope, and perhaps you will see that most interesting little organism known as the water bear. It is a diminutive animal, often found in drinking water, and looks very much like a bear. The extraordinary thing, however, about this tiny creature is that he is found in the gutters of houses, where he is at one time dry as dust and scorched by the blazing sun, at another active and full of life under a refreshing shower of rain. The water bear has the scientific name of tardigrada, because he takes life so easy. He is always fat and plump, and spends his waking periods in constantly grubbing with his four pairs of legs among whatever rubbish comes in his way. Having eyes, brain and a nervous system, he is much ahead of most of his tribe, and he is altogether one of the most interesting and amusing little animals known to science.

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Science Notes.

By means of the apparatus employed for collecting air at great heights in the ascent of the Aerophile on February 18, 1897, the following analysis of the air collected was made: In 100 vols. of air deprived of carbonic acid and taken at the height of 15,500 meters, there was found oxygen, 20·79 vols.; nitrogen, 78·27 vols.; argon, 0·94 vols. The ratio of argon to the total of nitrogen plus argon equals 0·01185.

Chemists understand that the laboratory at Cornell has the investigation of the "rare earths" quite to itself in America. Yet it is doubtful if it is anywhere known what a mass of these costly elements has been accumulated at that institution. A recent inventory disclosed that of didymium, which sells for $7 an ounce, Cornell has 300 ounces; of cerium, quoted at $6 an ounce, 400 ounces; of lanthanum, worth $35 an ounce, 30 ounces; and considerable quantities of yet rarer "rare earths" which cannot be obtained upon the market at all. Prof. Dennis, of Cornell, has made a life study of these elements, and has notably added to scientific knowledge in this field.

Prof. Harris, of Cornell University, is having built a naphtha launch which he will use in a summer course in the study of the fossil rocks of New York State and elsewhere. Science teachers in the schools of the State may take this course with no more expense than would attend a summer residence at Ithaca. Two trips will be taken this year, one down to Chesapeake Bay and its tributaries, and later in the summer a trip from Troy to Ithaca, in the course of which a complete view of the successive formations of the State will be had, beginning with the lowest paleozoic formations and coming steadily upward, collecting, sketching, and photographing each terrane. The launch is built so as to be of very light draught, for running up into shallow creeks. This will furnish an ideal way of passing the summer for those who wish to visit all parts of New York State at slight expense, live in the open air, and learn something.

The second volume of the Annales of the Meteorological Observatory of Mont Blanc contains papers on a greater variety of subjects than might be inferred from its title. The director, M. Joseph Vallot, contributes a record of observations made simultaneously at three stations—Mont Blanc, Grands Mulets, and Chamonix—during 1890, 1891, and 1892, and also, in a separate paper, describes the difficulties of making scientific observations at great altitudes. There are several memoirs on actinometry and one on the geological constitution of Mont Blanc. Of special interest to engineers is the description of the application of photography to the survey of the Mont Blanc group, and the account of the progress of the map of this region. The volume contains some interesting illustrations, and the views of the "Cuisine de l'Observatoire," and of the cozy "Chambre du Directeur," seem to show that home comforts are not entirely wanting even on the summit of the Alps. A third volume is announced to appear shortly, and a fourth is in preparation.

The Lowell Observatory, which was transferred from Flagstaff, Ariz., to Mexico early in December last for the purpose of observing the opposition of Mars and for the measurements of southern double stars, has been dismounted and shipped back to its original location, after three months' remarkable service. Dr. Lee, who was in charge of the observatory in the southern heavens, announces that since January 1 more than three hundred thousand double and triple stars had been measured. More than half were new, having never been reported by any astronomer. The report will be the largest and most important addition to the southern stellar astronomy since the observations of Sir John Herschel. Full reports of the work are to be forwarded soon to the Royal Astronomical Society at London. Among his discoveries are many brilliant stars, and perhaps fifty difficult stars separated by less than one second of an arc. In addition to these discoveries, his corroborative points of argument as to the formation of heavenly bodies will be exceptionally interesting.

Another Arctic expedition is being planned by Robert E. Peary, C.E., U.S.N., according to the representations made to induce the navy department to rescind the late order detailing Mr. Peary to duty at the Mare Island yard, California. Mr. Peary's plan, as now given out, is to purchase and load a ship with concentrated provisions; to proceed to Whale Sound and with the assistance of Eskimos land the stores at Sherard Osborne Fjord, or further north, if possible. The ship is then to be sent home, and as soon as the fjords freeze over sufficiently to permit sledge travel, the supplies would be advanced and cached in a line toward the pole. He would expect, in the following spring, to find his small party and the bulk of the provisions at the northern terminus of the North Greenland archipelago, probably near the eighty-fifth parallel, with a line of food caches extending to the starting point. From this point, and as the weather permitted, he would make a dash for the pole, with two of the best Eskimos, picked dogs, and the lightest possible equipment. No definite time of departure is fixed, as all the preliminary arrangements are not yet completed. But Mr. Peary expects to visit Greenland this summer, and there organize a force of Eskimos for the intended expedition and otherwise make preparations. He will also endeavor to bring back the one hundred ton meteorite found by him in Greenland.

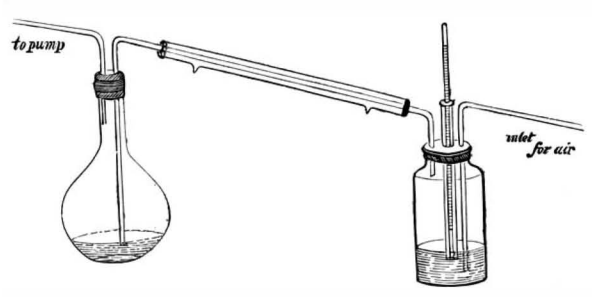
A SIMPLE METHOD FOR OBTAINING A LOW TEMPERATURE.*

BY C. EDWARD SAGE, F.C.S.

Having frequent necessity to observe the behavior of oils and fatty acids at a low temperature, I have been led to construct a simple piece of apparatus, which enables one to reduce the temperature of a sample in a very short space of time.

I venture to bring it before your notice, because I believe its use to be capable of extension to many purposes, and a short description will suffice to explain its construction.

A 6 ounce, wide mouthed flask or bottle is fitted with a good cork, which is to be pierced with three holes, one of which is to be large enough to admit a test tube, the other two are for the admission of two glass tubes. The inlet tube passes to the bottom of the flask, and the exit one passes only a short distance through the cork. The flask is partially filled with ether, and the sample to be examined is placed in the test tube together with a thermometer. Air is now forced into the flask by the inlet tube and made to bubble through the ether, whereby it exposes a large surface for evaporation, and, as this takes place very rapidly, the latent heat absorbed soon reduces the temperature of the sample. Instead of forcing air through the inlet tube, the exit may be attached to a Sprengel pump and the air sucked through. To prevent the waste of ether as far as possible, it is preferable to attach the exit tube to a condenser through which water is running, and to wash the air sucked through by means of cold water in a wash bottle; this water will, on subsequent warming,



yield a small quantity of ether, but the larger proportion is kept back by the condenser.

I have had several of these freezing bottles in use during the past summer, and found no difficulty in maintaining a temperature of —4° to —5° C. for a long period, even during the hottest weather, and if the test tubes were filled with water, it was converted into ice in a few minutes, with the expenditure of very little ether.

Opening of the Tennessee Exposition.

The Tennessee Centennial Exposition was opened at noon, May 1, with appropriate ceremonies, in the presence of many thousands of people. The weather was bright and clear and the parade was a great success, the public buildings and business houses and residences being handsomely decorated. The opening ceremonies were simple but impressive, and made a fitting tribute to one of the most memorable events in Tennessee's history. The ceremonies were opened with prayer by the Rt. Rev. T. H. Gailor, Coadjutor Bishop of Tennessee.

After "America" had been played, Major J. W. Thomas, president of the Tennessee Exposition Company, made an appropriate address, in which he reviewed the history of the undertaking and the hopes they had for the future. Addresses then followed by Gen. Taylor and Major E. C. Lewis. President Thomas then telegraphed to President McKinley that the Exposition was ready for him to open. President McKinley touched the button which started the machinery, and as the band played "Hail Columbia" the Tennessee Centennial Exposition was opened to the world.

GEN. HERMAN HAUPT, the well known civil engineer, recently celebrated his eightieth birthday at his home in Philadelphia. He is a graduate of West Point. He was the chief engineer of the Pennsylvania Railroad during its construction, and constructed the famous Hoosac Tunnel line in Massachusetts. During the rebellion President Lincoln placed him in charge of the military railroad bureau, rewarding him with several commissions. The first pipe line for transporting oil across the State of Pennsylvania was constructed by him, and he was instrumental in locating the Piedmont Air Line in the South and the Northern Pacific Railroad in the West. The application of compressed air to traffic has been largely developed by him, and he has been a prolific writer on scientific subjects.

* Read before the Chemists' Assistants' Association (London) and taken from the Pharmaceutical Journal.

Correspondence.

The Water Moccasin.

To the Editor of the SCIENTIFIC AMERICAN:

In the SCIENTIFIC AMERICAN of March 27 is an article on "Snakes," from the pen of Mr. L. P. Gratacap, in which he speaks of a visit to the American Museum of Natural History, and says he was shown specimens of the water moccasin, whose bite is almost as venomous as that of the rattlesnake. He further states that Mr. R. L. Dittmars, who showed him the snakes, had been engaged in collecting samples of their venom to be sent to the laboratory of Heidelberg for analysis.

Now, with all due deference to the opinion of Mr. Gratacap and Mr. Dittmars, I would state most positively that the water moccasin, which lives in the alluvial districts of Mississippi and Louisiana, and, in fact, throughout the Mississippi Valley, is not a venomous snake, as it possesses neither fangs nor poison sacs.

I have for some time past had a standing reward of one hundred dollars offered to any one who will bring me a poisonous water moccasin, and, although the number of all other kinds of snakes in this section of country put together would not equal that of the water moccasin, yet no one has claimed the reward, from the very simple fact that there is no such snake as a poisonous water moccasin in the Mississippi Valley.

What is known in the South as the dry land or cotton mouth moccasin is a very poisonous snake, and its bite is about as venomous as that of the rattlesnake. It is, however, not a water snake, although it is often found on the banks of small streams and rivulets in search of prey. The shape of its head, body and tail, as well as its color, ought to enable even a careless observer to distinguish it from the water moccasin.

I have been prompted to write the above article from the fact that Mr. Gratacap's essay was published in the SCIENTIFIC AMERICAN, and I fear many thoughtless persons will quote it as having been indorsed by that standard authority. F. W. COLEMAN, M.D.

Rodney, Miss.

To the Editor of the SCIENTIFIC AMERICAN:

In reference to Dr. Coleman's interesting protest as to my statements in your journal, I beg to say that the statement is correct, and that only the limitations of popular terminology would have led to any expression of dissent from your correspondent.

The snake I designated is commonly known as water moccasin, though also called cotton mouth, and when the necessities of intelligible conversation intervene, it is among collectors in this city and elsewhere alluded to by the former title, viz., water moccasin. To be, however, incontrovertible, the scientific name of Ancistrodon piscivorus Lacépède will establish its identity. Holbrook calls it "water moccasin."

Now in reference to its habits. Holbrook observes, "It is found about damp, swampy places, or in water—far from which it is never observed. In summer numbers of these serpents are seen resting on the low branches of such trees as overhang the water, into which they plunge on the slightest alarm." As to their affinity for water, no one who has kept them in confinement can entertain any doubt.

Of course the poisonous character of Ancistrodon piscivorus, L., is as well known to Dr. Coleman as to all ophidian students. If the customary uses of language in Dr. Coleman's vicinity limit 'cotton mouth" as the common name of this snake, certainly a wider habit of speech has very convincingly named it "water moccasin."

One word in conclusion. In nature the food of this snake is "such fish as he can overtake, and few exceed his velocity in swimming."—Holbrook.

I trust Dr. Coleman will exonerate me from any serious misstatements, such as he charges. I do not think I could have been misunderstood by herpetologists generally. Thanking you for the opportunity of this reply, I am, yours faithfully, L. P. GRATACAP.

New York City.

Novel Patent to Curb the Use of Tobacco.

A time lock for tobacco boxes, recently patented by Grant W. Smith, of O'Neill, Nebraska, is designed to control the supply of chewing or smoking tobacco carried by the user of the weed, and enable one who so desires to limit himself in its use. The tobacco box, according to this improvement, has one compartment for the tobacco and another in which is a clock gearing with time indicating and time controlling notched dial adapted to engage or release a latch hook by which the lid of the compartment containing the tobacco is closed. The victim of the tobacco habit may regulate the mechanism so that he can have access to the tobacco in the box at stated times only, and thus, in the words of the inventor, "control his appetite therefor and resist inclination to its inordinate use;" so that, "by gradually increasing the length of time between such acts of indulgence, the habit of tobacco chewing and smoking may be greatly restricted, and cured in course of time, as its effect on the system is gradually diminished."

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TRINITY'S BRONZE DOORS.

The bi-centennial celebration of Trinity parish, New York City, began May 2. It is not often in America that a church is able to celebrate the two hundredth year of its foundation; for this reason the present occasion is all the more memorable. The bi-centennial was fittingly celebrated by services which extended over a period of a week and which were confined not only to Trinity Church but included the other churches and chapels of the extensive parish.

The interior is worthy of visitation at any time, as it is an unusually handsome church. On the present occasion the decorations were of the most beautiful and costly description. At the head of each supporting pillar of the nave was a marble angel supported upon a pedestal. Each angel held in each hand a white flower which glowed with electric light burning at its center. There was also a profusion of heraldic shields and banners. The nave was also lighted by an elaborate system of incandescent lights behind beautiful ground glass globes representing flowers.

The floral embellishments of the church were uncommonly beautiful. The base of each window was a mass of lilies, roses and other flowers. The chancel, altar and reredos were even more finely decorated in the same way. Altogether, the decorations of the church show what can be done by an almost unlimited expenditure of money when that expenditure is in the hands of those guided by perfect taste.

The occasion of the celebration is so interesting that we present an engraving of the bronze doors which give entrance to the tower. These doors may be regarded as the most important work of art which the church possesses, and the doors show the advanced state of art work at which we have now arrived in this country, as the doors were both designed and executed in America.

On March 10, 1890, the Vestry of Trinity Parish received a letter from Mr. William Waldorf Astor, saying that he wished to give three doors in memory of his father, John Jacob Astor, to Trinity Church, New York City. He asked the vestry to approve of his proposal and to authorize him to carry his desire into effect. Permission to erect the doors being obtained, Mr. Astor employed the late Richard M. Hunt to furnish the plans and superintend the construction of the doors. Mr. Hunt then applied to the rector of Trinity Church requesting suggestions for the subjects of the panels, of which there were to be eighteen in all, six for each door. The front or tower door was committed to Mr. Carl Bitter, the sculptor. Mr. J. Massey Rhind obtained the commission for the northern door, and Mr. C. B. Niehaus that for the southern door.

We illustrate one of the doors, the front or tower door, and it will be described more in detail. The panels of the northern door might bear for their general legend the words of Christ, "I am the Door of the Sheep." Its scenes are representative of the men who, in different ages of the world, have been delivered from tribulation and brought into places of security and rest. The subjects of the panels are the Passover in Egypt; the Flight for Safety to one of the Cities of Refuge; the Deliverance of Paul and Silas from Prison; the Healing of the Lame Man by St. Peter at the Gate of the Temple; and four panels of a legendary and symbolical character. From an artistic point of view this door is perhaps the finest of the entire series.

The south door represents a series of scenes in the history of Manhattan Island and of Trinity Parish. The first panel illustrates the arrival of Hendrick Hudson off Manhattan Island in the year 1609. The second commemorates the missionary character of the work of Trinity Church in ancient times. It represents the Rev. Henry Barclay, D.D., preaching to the Indians. The third panel brings us to the close of the revolutionary war and to the date of the inauguration of George Washington, the first President of the United States of America. The event which the panel commemorates took place in New York immediately after the ceremonies in Wall Street, when General Washington proceeded to St. Paul's Chapel, where a religious service was held. The other panels deal with scenes connected more particularly with the later history of the church. The more modern panels are hardly as effective as those which treat of earlier events, as the costume of to-day is not well adapted for translation into bronze.

The front door consists, like the other doors, of two bronze valves rectangular in shape, three panels in each; apostles in carved stone appear in the transom sitting on thrones, while the tympanum contains a figure of Christ stretching forth His arms in welcome to the faithful. It is intended that the panels be examined in pairs, the lowest concerning the advent of Christ, the second His life on earth and the last His reign in heaven. The expulsion from Paradise occupies the first panel, while the second is Jacob's Dream. The third contains the Annunciation to the Virgin. Its companion is the empty tomb of the risen Lord, symbolical of the victory of life over death. The top panels, which are the least pleasing of the series, contain visions from the Revelations of St. John the Divine. One of the panels represents the worship of the Church before the Throne, and the other Angels casting down the Kings of the Earth. Many smaller sculptures are included in the work. Four figures below the lowest panel represent Mortality, Sin, Time and Tradition. Recumbent figures above the top panel represent Energy and Divine Justice. Other statues of Abraham, Moses, the apostles and saints, etc., also form a part of the work.

THE MAIN BRONZE DOORS OF TRINITY CHURCH.

It is said that the three doors cost about $165,000. Trinity Church is a treasure house of art works. The splendid reredos of Caen stone, the marble altar, with its exquisite mosaics, and the jeweled cross are worthily crowned by the splendid doors which give entrance to the church.

These doors are, however, interesting from another point of view besides that of art, for they are splendid examples of the bronze founder's art. It is a satisfaction to know that it is no longer necessary to send works to Munich, Paris or Rome to be executed, and that the industry may now be said to have become thoroughly naturalized in the United States. For many years monumental bronze work had to be executed abroad, but splendid examples of casting are now executed here, casting in which the highest technical skill is combined with strict fidelity to the sculptor's models.

Bronze statues were made two and perhaps three thousand years ago, the earliest consisting of small plates hammered into the desired shape and fastened together by nails or rivets. After this they were cast solid, and also with a core. At the present time it is the general custom to divide the statue, when of heroic size, into several sections, make a separate casting of each section and then unite the parts by riveting; the joint so formed, owing to the increased thickness of the metal, being of greater strength than the adjoining parts. But a great step in advance was recently made by the Henry-Bonnard Bronze Company, of this city, when they succeeded in casting practically in one piece Mr. J. Q. A. Ward's statue of the New England Pilgrim. To this achievement they have added the greater one of casting each valve of the Trinity doors in one piece, and it is interesting to note that they secured the execution of these last monumental works, though they were more than $14,000 higher than the other bidders.

Casting in bronze does not consist solely in simply taking a pattern, making a mould and running in the metal. It is an art only to be acquired by long and patient toil, close study and that most essential and spurring incentive, a fascination for the work. That success can only be achieved by this means will be understood by any one who will spend an hour in a bronze foundry and note the time and care spent in making sure that one step is perfected before the next is even approached. There is no sign of the presence of that most pernicious habit, too frequently permitted in other callings, in which a distasteful part may be slurred or left half finished and a rush made for something more agreeable. The bitter and the sweet must receive the same attention, as both are equally dangerous when slighted.

It is apparent that the panels in which the relief is in some cases three to four inches will not "draw." Yet this is no obstacle to the bronze founder, and in the case of the Trinity doors piece moulding is carried to its perfection. Each undercut means that one or more pieces are required for it. Each valve of the Trinity doors required approximately two hundred pieces, each made of French sand bonded together with iron carcasses and built up on wires and clamps. The workmen often spent weeks on a single panel. The pieces were then all assembled and the doors were ready to be cast. To distribute these pieces of sand and remember where each piece belongs is a task of no small magnitude. Gates somewhat resembling a tree and branches were provided to insure that the mould was properly filled; vents were also provided to allow for the escape of the gases. The bronze was melted in crucibles, and was composed of 90 per cent copper, 7 per cent tin and 3 per cent zinc. That the composition was of superior quality is shown by the fine color which the gates have already taken on. The alloy was heated for twenty-four hours. After the cast was made (the flask then weighing 27 tons) the mould was broken open and the doors were taken out, the vents and gates were removed and the necessary finishing, chipping, filing, etc., then took place, though surprisingly little was needed in the case of these doors.

Each pair measured 10 feet 2 inches by 8 feet 6 inches; so that some idea of the enormous amount of labor expended on them may be obtained. It required two years to mould and finish the main door shown in our engraving and three years ten days on the three sets. Notwithstanding the great weight of the doors, they open and close as easily as ordinary doors of the same size.

Comparisons with other celebrated bronze doors from a technical point of view are instructive. The Washington doors, which were cast in Munich, are very fine, but were cast in pieces. The second gate of Lorenzo Ghiberti (fifteenth century) for the Baptistery of Florence, required twenty-seven years of labor to complete it and it was cast in pieces. When it is considered that only four years was consumed in modeling, moulding, casting and finishing the three sets of doors for Trinity, it will be seen that both technical processes and the speed and facility with which the sculptors now turn out models have improved, though, of course, artistic comparison of Ghiberti's glorious gate and those of modern sculptors is hardly fair.

THE new "annuaire" of the French Automobile Club, which has just been issued, shows that the club has now close upon 1,000 members. Those possessing motor carriages or motor cycles have a small illustration of a motor vehicle against their name, the total number of actual "chauffeurs" being 139.

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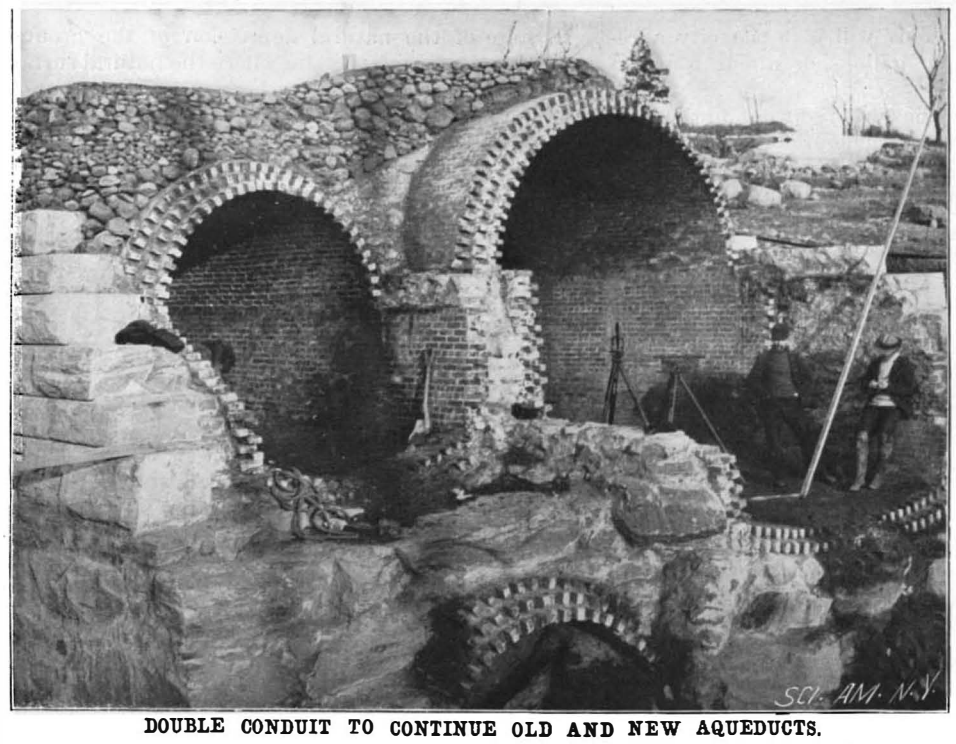
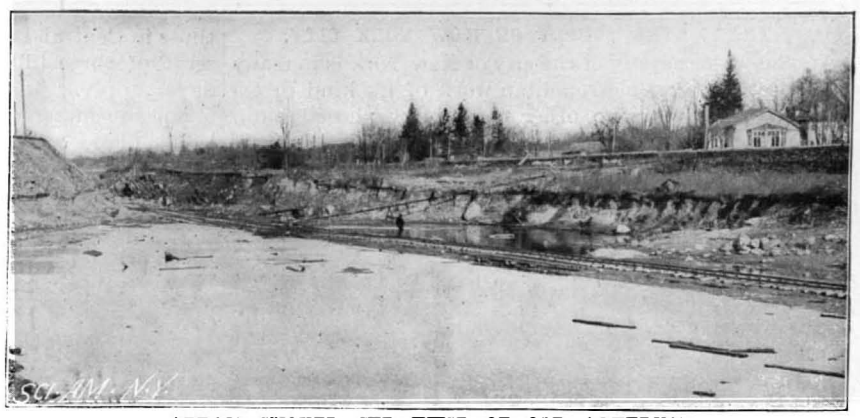
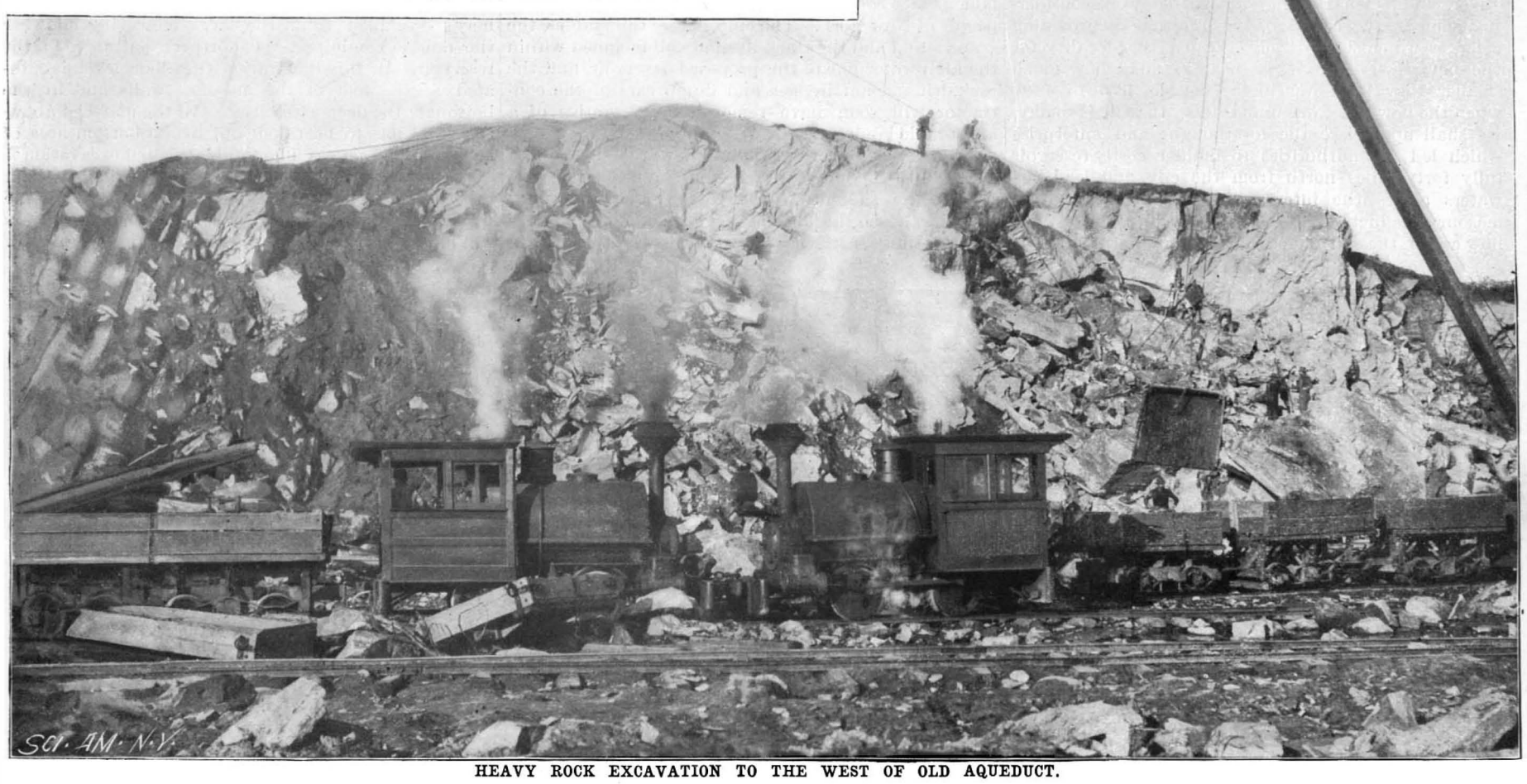


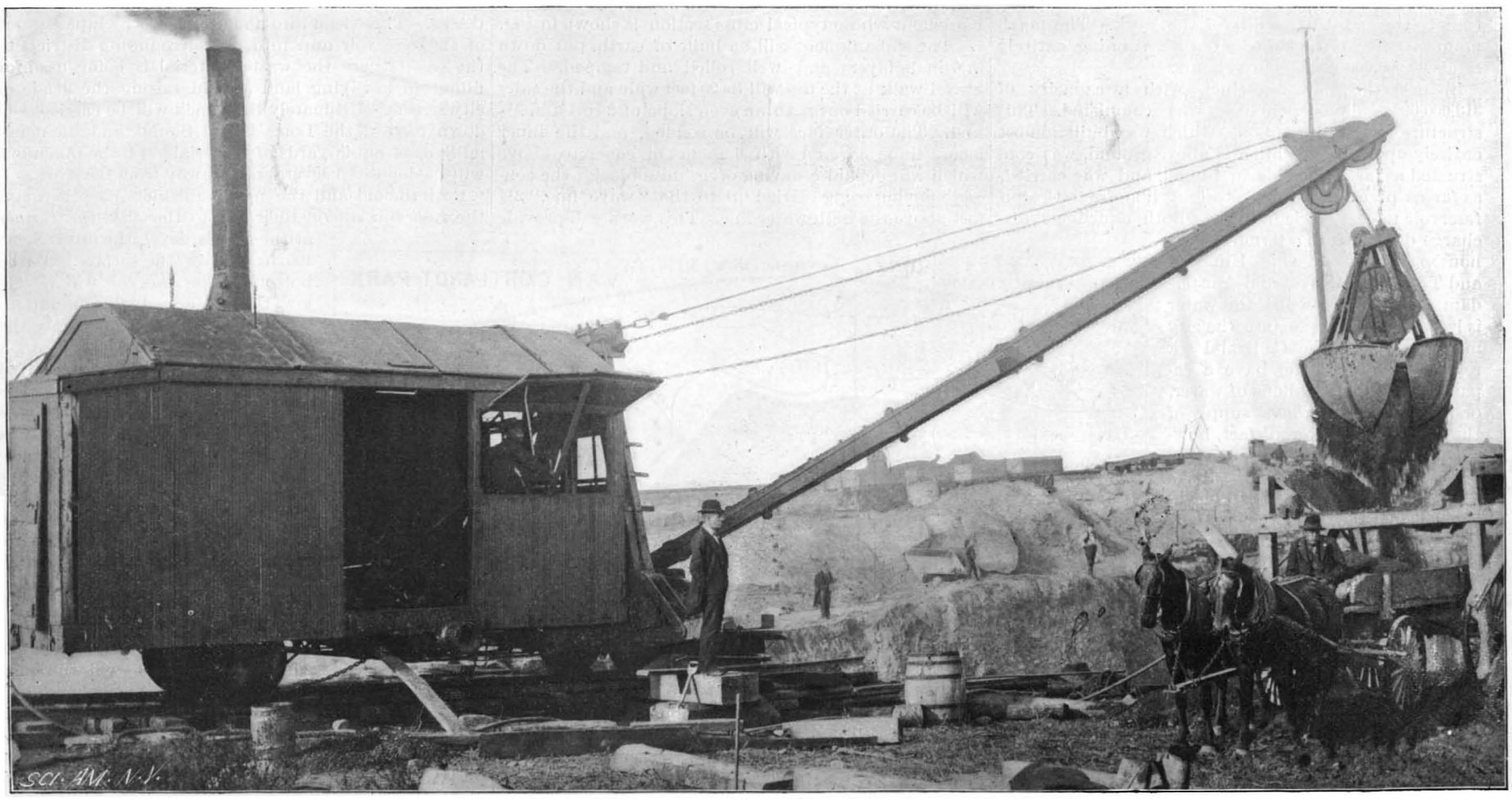
DOUBLE CONDUIT TO CONTINUE OLD AND NEW AQUEDUCTS.



STEAM SHOVEL CUT WEST OF OLD AQUEDUCT.



HEAVY ROCK EXCAVATION TO THE WEST OF OLD AQUEDUCT.



STEAM DREDGE EXCAVATING FOR FOUNDATIONS OF DOUBLE CONDUIT.

THE WATER SUPPLY OF NEW YORK CITY—JEROME PARK RESERVOIR.—[See page 314.]

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THE WATER SUPPLY OF NEW YORK CITY.

The water supply of the city of New York is in many respects the best metropolitan work of its kind in existence. There is no other capital city whose inhabitants receive such an abundant per capita supply of pure water for general domestic use; and it is satisfactory to know that, while the existing reservoirs are sufficient to meet the city's needs in the near future, there are important works in progress which will give a water supply far in excess of the city's immediate requirements and sufficient to cover its probable growth for many a decade to come.

Nature has provided a magnificent supply of pure water in the annual rainfall of the watershed of the Croton River, and when the city authorities were considering, some sixty years ago, the question of providing a larger water supply, they selected this locality for the new reservoir. If we bear in mind how much smaller New York was in the decade 1830 to 1840, when the new work was undertaken, than it is to-day, we shall appreciate the forethought and enterprise which led the authorities to build a costly reservoir fully forty miles north from the city and lead the waters across the intervening distance in a solid masonry viaduct. The Croton aqueduct, or, as it is now called, the old aqueduct, is a familiar landscape feature to travelers over the old Albany post road (better known as Broadway), and the unbroken service which it has rendered for more than half a century testifies to the excellent quality of the work. The maximum capacity of the aqueduct when running entirely full is 90,000,000 gallons in 24 hours.

In 1890 the new aqueduct, with a capacity of 313,000,000 gallons per day, was completed. This structure, unlike the old one, which was built almost entirely upon the side hill and above ground, was constructed as far as possible in tunnel, and was carried, as far as practicable, in a straight line from Croton reservoir to the Harlem River. Both aqueducts discharge directly into a terminal gate house, situated at One Hundred and Thirty-fifth Street and Amsterdam Avenue, from which the water is led by 48 inch pipes into the city mains and into the Central Park reservoirs. The latter have a capacity of a billion gallons of water, or sufficient for five days' supply of the city. As a matter of fact, however, the high water level of these reservoirs is only 115·00 feet above the sea, and before they can be entirely exhausted, the pressure fails and the remaining water ceases to be available on the higher floors of the city buildings.

For this reason the actual supply is limited to three and a half or four days, and in the event of a failure in the Croton reservoir or of the two aqueducts above mentioned, the city would be brought within measurable distance of a water famine. Although such a contingency as the failure of both aqueducts or of the reservoir is remote, the aqueduct commissioners have wisely determined to enlarge the reservoir capacity at the city end of the line by constructing an additional reservoir which will have about double the capacity of those in Central Park. This will give the city a reserve of three billions of gallons, or about fourteen days' supply.

The site chosen for the new reservoir lies on the high ridge of land which runs in a general north and south direction between the New York & Putnam and the Harlem railroads. It will be known as the Jerome Park reservoir, taking the name of the park whose famous race course was once a favorite resort of the people of New York. The club house, the stables, the grand stand and the track itself are all included within the high water line of the proposed reservoir, and the rock drills, steam dredges and dump cars of the contractor will soon have removed every vestige of a memorable landmark.

From an engineer's point of view, the site is well adapted to the purpose. It forms a general depression on the summit of the ridge, and Nature has helped to lessen the labor of digging out and embanking this huge artificial basin, the depth of which will be 26½ feet and its area nearly 175 acres, by surrounding it for half the total distance with rising ground. The other half of the distance will be shut in by an embankment whose typical cross section is shown in Fig. 1. The embankment will be built of earth, put down in 6 inch layers and well rolled and tamped. The gravel walk at the top will be 20 feet wide and the sides will be carried out with an even slope of 2 to 1 and 2½ to 1. The outer face will be sodded, and the inner face will be covered with 6 inches of concrete, above which will be laid a paving of granite blocks, the concrete paving being carried up to the "wave line," 2½ feet above the high water line. This work will provide a practically impervious surface; but, to prevent any possibility of leakage, an inner wall or diaphragm of first-class masonry will be built in the center of the embankment, starting from bed rock and rising with a batter of 1 in 24 to well above the high water line. The core wall adds no appreciable strength, however, to the dam, which resists the thrust of the water by its own gravity.

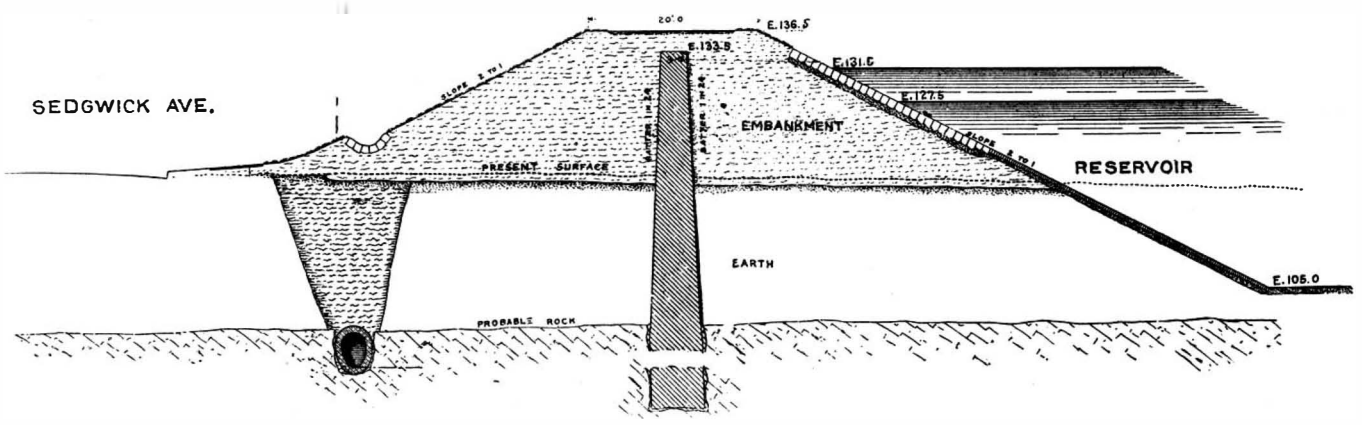

Fig. 1.—TYPICAL SECTION OF RESERVOIR EMBANKMENT.

In spite of the natural depression of the ground, there is no part of the site where the natural surface is less than 16 feet above the bottom of the proposed reservoir, which will in general be 31½ feet below the top of the embankment. Moreover, there are several stretches of rising ground, such, for instance, as that upon which the old Jerome Park club house stands, which rise considerably above the level of the top of the embankment. Every yard of this material, fully one-half of which is rock, has to be laboriously excavated, loaded into cars, hauled by locomotives out of the reservoir and deposited wherever the contractors can obtain permission to dump it. An impressive idea of the vast amount of excavation that has to be done before the floor of the reservoir is reached may be gained from the large engraving showing the double conduit at the northern entrance to the reservoir. In this illustration the floor level is situated at the foot of the masonry walls and at the bottom of the deep excavation. All the material above this level has to be taken out over a bottom area of more than 150 acres. The total estimated excavation is 6,500,000 cubic yards, of which fully one-half is solid rock, and, as excavated rock occupies about double the space that it does in the solid mass, the contractors will have to dispose of nearly 10,000,000 cubic yards of material. The excavation is being done with powerful steam dredges and shovels, and the site of the reservoir is at present well covered with a whole network of tracks. These lead into a main track which passes out of the reservoir and into the surrounding districts to the east, where the waste material is being used for filling in low-lying land and in raising the grade of city streets. Ultimately this track will be carried well down toward the Long Island Sound, and the many millions of cubic yards of material yet to be taken out will be deposited several miles away from the work.

Both the old and the new aqueducts pass through the reservoir site on their way to the city, the former at the ground level, the latter some 100 feet below the surface. As the bottom of the reservoir will lie below the old aqueduct foundation, it will be necessary to remove the latter structure altogether. At a point about a mile to the north of the reservoir the new aqueduct is at the ground level, and it is here that it is depressed and carried in a tunnel to the deep level above mentioned. At about the center of the reservoir a vertical shaft, known as shaft 21, rises from this aqueduct to the bottom of the reservoir. At the point to the north above mentioned, where the change of grade occurs in the new aqueduct, a gate house has been put in and a surface branch aqueduct will be built, which will run parallel with the old aqueduct, until the northern entrance of the reservoir is reached. Here the two aqueducts will be continued in one compact masonry structure, as shown in the large front page engraving. This will be built upon the solid rock and will run through the reservoir from north to south, dividing it into two equal and entirely separate basins, the top of the structure being level with the

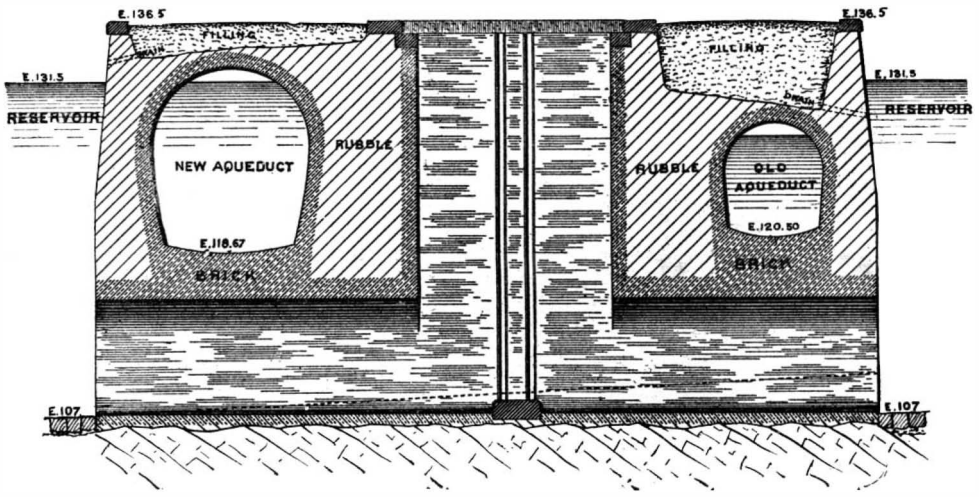

Fig. 2.—SECTION THROUGH DOUBLE CONDUIT ABOVE MAIN GATE HOUSE.

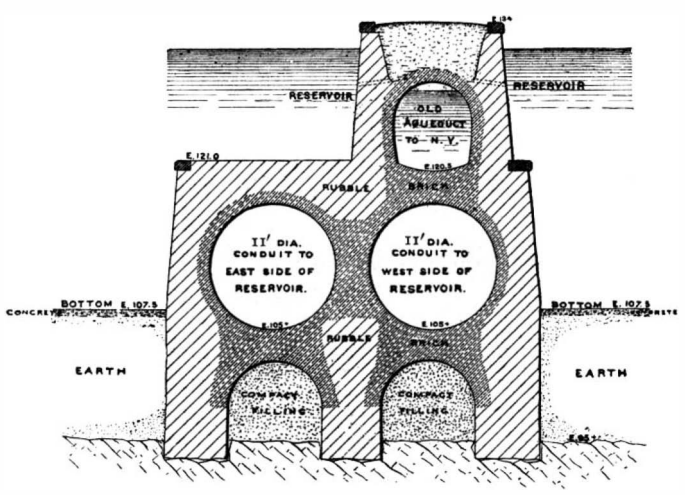

Fig. 3.—SECTION THROUGH DOUBLE CONDUIT BELOW MAIN GATE HOUSE.

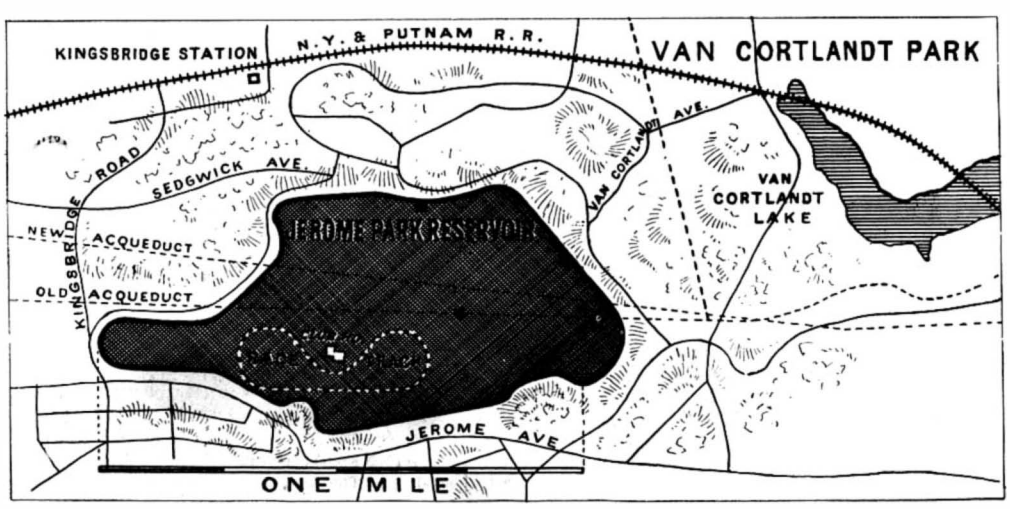

Fig. 4.—MAP OF JEROME PARK RESERVOIR AND VICINITY.

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top of the embankment, or 5 feet above high water level.

At the center of its length, and opposite the shaft 21 leading down to the new aqueduct, a large main gatehouse will be built, from which a short conduit will lead across to connect through this shaft with the new aqueduct below ground. To the south of the main gate house the new aqueduct is continued as a double barrel conduit, each barrel being 11 feet in diameter, and the old aqueduct is carried above these at its former elevation, as shown in Fig. 3. At a point 1,500 feet to the south of the gatehouse one conduit leads into the western and the other into the eastern half of the reservoir. By this arrangement three separate systems of distribution of the water are secured. The reservoir may be filled or the water distributed directly from either the old or the new surface aqueducts, or from the subterranean aqueduct through shaft 21, the operations being all controlled at the main gate house. The construction of the dividing wall of the reservoir is shown in the two cross sections, Figs. 2 and 3, and it will be seen that the arrangement is such as to afford two entirely independent reservoirs, each with its own separate system for feeding and distributing the water.

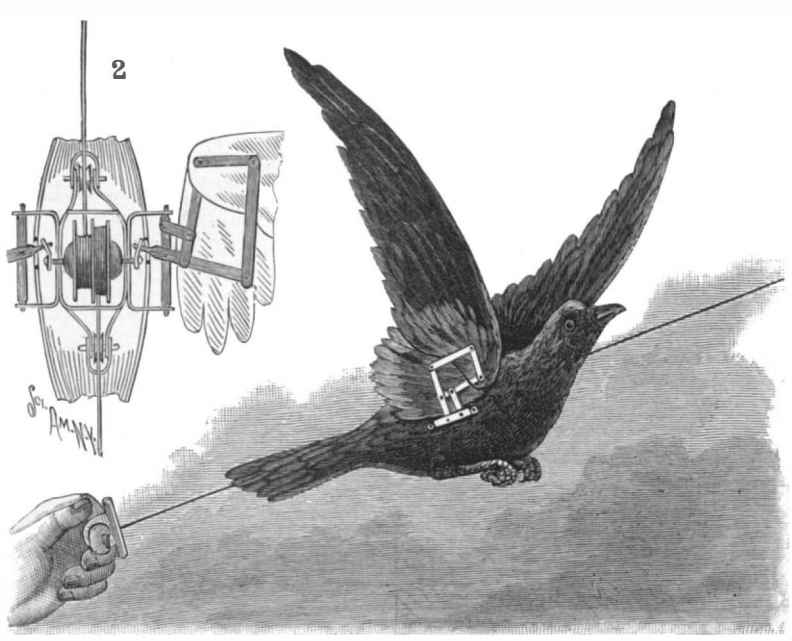
Six lines of 48 inch pipe will radiate from the main central gate house; two of which will leave the reservoir at Van Cortlandt Avenue to the northwest, two at Sedgewick Avenue to the west, and two at Jerome Avenue to the southeast, one of which will lead to a high service pumping station. A gate house will be built at each point of exit. The main gate house connections will be so arranged that these pipes may be supplied with water from either basin of the reservoir or directly from either the old or new aqueduct. The 48 inch pipes, with the aid of the proposed pumping stations, will serve the annexed district to the north of the Harlem River, and it is also proposed to carry a line from these pipes south across the Harlem River to connect directly with the city mains on Manhattan Island. This would give an independent source of supply in case of any accident to the present aqueducts where they cross the Harlem River.

When the Jerome Park reservoir is completed it will form an extensive lake of water over a mile and a quarter in length and more than half a mile in width; and the winding gravel walk on the top of the embankment will afford a continuous promenade fully three miles long. The contract calls for the completion of the work in 1901. A few years later than this the great Croton dam which is now building at a point a few miles below the old Croton dam will be completed, and the new lake thus formed will hold over 30,000,000,000 gallons. If we add to this the capacity of the various auxiliary storage reservoirs scattered throughout the Croton watershed, and that of the reservoirs at Jerome Park and Central Park, we reach a grand total of 75,000,000,000 gallons as the future available supply of New York City.

The work is being carried out under Mr. A. Fteley as chief engineer. Mr. A. Craven is in charge of construction at Jerome Park, and to these gentlemen, together with Mr. F. S. Cook, assistant engineer, we are indebted for valuable facilities in the preparation of the present article.

A TOY BIRD THAT FLIES.

The naturalness and easy movement of the wings of the little toy bird shown in the accompanying illustration, as the operator pulls gently on the end of the supporting string over which the bird moves, in accordance with the movement of the wings, always attracts observers when this toy is shown on the streets, as it has been by numerous venders within a few weeks past. The toy is one of the most recent of the many novelties which are constantly being exhibited by the sidewalk salesmen in the streets of New York and other large cities, and in the construction of some of which a surprising degree of skill and ingenuity are displayed. The cord leading from the aperture below the mouth of the bird is attached at its outer end to a hook in the wall or other support, while its inner portion passes over an idler and around a pulley, to which it is attached. This pulley is a little smaller than another at its side, as shown in Fig. 2, both pulleys being fast on the same shaft, and a cord from the larger pulley passes over an idler and out rearwardly, having at its end a finger piece, on which the operator pulls in manipulating the toy. The cords are wound in opposite directions on their pulleys, so that the unwinding of the cord from and rotating of the larger pulley winds up the cord on the smaller pulley, and causes the bird to move forward on what seems to be only a single length of cord, the backward movement taking place by gravity when the pull on the string is released. The movement of the wings is effected by a crank on each outer end of the pulley shaft, the crank being pivotally connected with an extension of a member of the inner one of two pairs of lazy tongs, and this member having also a pivotal bearing on a cross bar which turns in bearings on the outer side of the toy, just under where the wings are hinged to the body. The larger pair of lazy tongs is pivotally connected to the outer portion of the wing, giving a longer sweep thereto than to the inner portion of the wing, with which the smaller lazy tongs are connected, and the pivotal connection of the lazy tongs with the bearing in the cross bar gives an oscillatory movement to the wings which constitutes a very good simulation of the natural movement of the wings of a bird in flight. A high degree of mechanical skill is shown in the putting together of this little toy.



A TOY BIRD THAT EFFECTIVELY SIMULATES A BIRD FLYING.

AN electric speed indicator which is designed specially for warships is described in the Revue Industrielle. The principle is that a tiny magneto, driven off the main shaft, gives a current which varies with the speed. A galvanometer introduced anywhere in the circuit, therefore, if properly graduated, gives the number of revolutions per minute, and the direction "ahead" or "astern."

RECENTLY PATENTED INVENTIONS.

Electrical.

VALVE GEAR.—William Engberg, St. Joseph, Mich. The gear provided by this patent is more especially designed for use in water supply pipes connecting a pumping station with a distant stand pipe. It is provided with a controlling device comprising an electric circuit containing two relays, an electric magnet for each relay and an armature lever, and two slidable bars adapted to be engaged and locked by the corresponding armature levers, the bars controlling the position of the valve. An alarm is sounded at the pumping station in case the valve is opened or closed accidentally.

AMALGAMATOR.—William Wright, New York City. This invention provides for an amalgamating plate over which the material is adapted to pass, water-distributing tubes being arranged to discharge water over the receiving surface of the plate, the tubes having carbon outlets, and the plate and tubes being in an electric circuit, while mechanism is provided for changing the direction of the current. When the amalgamating surface becomes clogged the current is reversed, in order to loosen the sediment and provide at all times for a clean surface to which the gold shall adhere.

Mechanical.

MOTOR REGULATOR.—John G. Ball, Chesterville, Ohio. A simple device, adjustable for various purposes, is provided by this invention, and consists of a frame in which is rotatably mounted a wheel having a series of weights secured to its periphery, arranged in such a way that the wheel is overbalanced on one side. An adjustable sweep rod connected to a crank arm or axle of the wheel is adapted to be engaged with mechanism having an attachment to a pump rod or similar device, a spring being adjustably connected to the sweep rod. The device is adapted for use with pumps for wells of different depths, churns of different sizes, and similar machinery where it is designed to operate a rod vertically and at varying rates of speed.

MOULD.—Robert H. Wilson, Boonton, N. J. This improvement consists of two plates having the mould formed in their opposing surfaces, and provided with automatic centering means by which they are made to register by simply sliding the cope upon the mould until stopped by the centering devices. There is also provided a removable and insertible pouring gate and riser, which is made in one piece of a refractory earthy material, and which protects the mould at the points where the heat of the metal is most likely to affect it, also enabling the gate to be easily removed.

JOURNAL BEARING.—Richard M. Melhuish, London, England. This bearing comprises a standard having an opening in which a bearing block is seated to move, a plate holding the bearing block in place, and the bearing block being longitudinally opened in its under side, whereby, when the slightly separated parts of the bearing block are drawn together to take up the internal wear around the journal, the outer lower edges of the block will be depressed to take up the external wear. The improvement affords a ready means of correcting both the internal and external wear of the bearing block.

MAKING CYCLE GEAR CASES.—Horace W. Dover, Northampton, England. For making gear cases of xylonite, celluloid, etc., this invention provides a finishing tool for bringing the roughly moulded article to its final form. The tool comprises a male die or plunger, a matrix formed of a middle member inclosing the bottom and ends, with two loosely pivoted side members, and means for forcing and holding the die in the matrix, and for closing the sides of the matrix upon the article on the die. The plunger is forced home and the sides of the matrix closed in with the aid of heat, preferably while the tool is immersed in water at a temperature to soften the material, the material being caused to set in the moulded form by cooling the mould in cold water.

Agricultural.

STOCK WATERING DEVICE.—Joseph Seiler, Maple River Junction, Iowa. A device adapted for attachment to a tank, barrel, reservoir, or other source of supply, is provided by this invention, for use in connection with a trough or tank, cutting off the supply from the latter when the water has reached a certain height. It has a T-shaped body, with a plug in its vertical member, the outlet nozzle having a valve adapted to be closed by a trip rod which extends beyond the outlet end and engages a float. When the water in the trough gets below a certain level, the float lifts the valve to allow more water to flow in from the reservoir. The device may also be attached to and used in connection with a hydrant.

SORTING MACHINE FOR PEACHES, ETC.—John P. Wilson, Hamburg, N. J. This machine has carriers adapted to move over the assorting table, but which may be stopped at any point to make sure that the fruit or vegetables are of a size adapted to find an exit. Means are provided for regulating the feed to the assorting table, and the basket, crate, or bag holder occupies at first an inclined position, gradually assuming an upright position as the bag, etc., becomes filled, thereby preventing the bruising of the fruit or vegetables. The carriers may be readily and easily set in motion, and their motion is preferably continuous.

Miscellaneous.

BICYCLE RACK.—George Hirschman, Sr., and George Hirschman, Jr., Morristown, N. J. A portable rack of simple and inexpensive construction, and adapted to support a number of bicycles, has been devised by these inventors. The device comprises vertical and base rack bars pivotally connected together by means of base blocks, transverse rods serving as stops for the wheels, the base racks being adapted to be held at right and acute angles to the vertical racks, and the whole device being adapted to be folded in comparatively small compass. A wide space between the wheel-supporting bars provides room for the handle bars of the several bicycles.

BICYCLE TIRE.—James C. Cole, London, England. This invention provides a tire made of segments or balls or oblate or flattened spheroids or ovals, preferably made of India rubber and inflated, but with the balls partially lined with a strong textile or inextensible lining. There are flanges or ribs on the balls for their attachment to the wheel, and the lining of the ball is of such width that its extensible part is only about that which may be flattened by contact with the adjacent balls. It is designed that the balls so made shall be extensible only in or about the direction of the circumference of the wheel.

PRESERVING FOODS.—Francois O. Jacob, Paris, France. To preserve solid organic alimentary substances from fermentation and decomposition, this inventor makes use in certain cases of an acid reaction and in others of a basic or neutral reaction. The process is especially designed to facilitate the preservation of meat, fish, fruit, vegetables, etc., and the substances to be preserved are treated with carbonic anhydrid and formaldehyde, under pressure, either successively or simultaneously. It is said that meat thus treated can be kept in the open air for more than a month, and is without smell and contains no toxic principle or anything contrary to the hygiene of alimentation.

WINDMILL.—Rudolph Bratka, Minnesota Lake, Minn. The wheel of this windmill is mounted on a vertical axis and turns in a horizontal plane, the blades of the wheel being pivoted on arms radiating from the axis, and swinging from a horizontal to a vertical position as the wheel turns. Each blade is actuated by a spring, and as the spokes or arms move toward or into the wind the force of the springs is overcome and the blades are thrown horizontally, but when the arms pass the line in which the wind is blowing, the springs change the position of the blades, allowing the wind to act with the greatest possible efficiency on the wheel.

CHIMNEY.—Le Roy C. Hedges, Elmwood, Ill. This is a metal-framed chimney which is light, strong, and ornamental, and designed to support and strengthen other portions of the building, while being fireproof, inexpensive, and easy to repair when necessary. The invention comprises a casing in which is a draught flue, brackets on the casing supporting the joists, etc., while there are tiles on the brackets between the casing and the ends of the joists and floor. There are openings near the floor and ceiling of each compartment, and heat radiators through which the products of combustion pass, the chimney being designed to be a fuel saver as well as an effective heat distributor for rooms directly connected with it.

LAMP LIGHTING DEVICE.—Carl F. Bergmann, Jersey City, N, J. For lighting the wicks of bicycle lamps, more particularly, this invention provides a novel attachment which will facilitate the easy and protected ignition of the match, and guide it into contact with the wick to be lighted. A guide tube penetrates the wall of the lamp near its burner, and near the inner end of the tube is a spring-pressed scratching device adapted to ignite an inserted match, the tube being completely closed when the match is withdrawn, and thus preventing air currents from flaring the flame of the lighted wick.

SEWER GAS TRAP.—Henry McEvoy, New York City. This invention provides a simple form of trap that will be sealed automatically by water or by a valve movable into a discharge pipe. This valve is mounted on a tubular arm which extends through the valve, and the tubular arm connects with a water inlet tube designed to communicate with a water supply pipe. The connection of the tubular arm and its valve is such that, as water evaporates from the elbow and bowl, a small amount of water is admitted to replenish the amount evaporated and maintain a liquid seal.

LADDER AND COT.—Leonard G. Fath, Springfield, Mo. This is a combination device to be used by a slight adjustment as a cot, a step ladder, or an extension ladder, a cot surface of woven wire, etc., being discarded when the device is used as a step ladder. The device is made of two principal parts, a step ladder portion and a pair of parallel bars, both the side pieces of the ladder portion and the parallel bars having three pivot holes one near the middle and one near each end, whereby adjustment as a cot may be effected by means of pivot bolts and link rods.

FIRE EXTINGUISHER.—Arthur H. Durand, Montreal, Canada. This is a portable fire extinguisher which operates by the admixture of an acid with a solution of bicarbonate of soda to generate carbonic acid gas. The invention provides an acid receptacle formed by a contraction of the vessel containing the alkaline solution, and so arranged that the acid can be slowly admitted, and not all at once, the pressure being thus so regulated as to avoid danger of bursting the extinguisher, which sometimes happens from the sudden generation of an enormous volume of carbonic acid gas. A small extinguisher is thus provided which will be perfectly safe and of sure operation, and the machine may be readily recharged at any drug store, as no pieces are broken or out of order after use.

BUSHING AND HOLDER FOR RUBBER GAS BAGS.—John Heavue and Elmer E. Cisco, Brooklyn, N. Y. This invention relates to flexible gas bags temporarily employed for plugging gas mains during repairs, and provides a bushing adapted to be inserted in the opening in the main and a cap for attachment to the bushing to close it, and with means to hold the neck of the gas bag, holding the latter in place when inflated in

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the main. The device also protects the bag against being torn and damaged by contact with the rough and sharp edges of the opening in the main at which it is inserted or withdrawn.

LOCK.—Jacob C. Hollman, Carbon Black, Pa. A lock which may be readily and conveniently mortised into any door, without appreciably detracting from the strength of the door, is provided by this invention. The bolt and the latch, according to this improvement, are in separate cylindrical compartments or casings, to the outer end of which a face plate is secured, the upper cylinder being preferably the latch cylinder. In placing the lock it is only necessary to make spaced bearings for the cylindrical casings and a countersink for the face plate, in addition to the openings for the knob spindle and key.

NON-REFILLABLE BOTTLE.—William W. Doty and James J. Donnellan, New York City. This bottle has a stopper with an annular channel, the center piece being connected by wings with the outer portion of the stopper, while a cap has in its under side a screw entering the center piece, and a rod connected with the screw and extending through the center piece has an enlarged portion at its lower end on which a valve is guided. In manufacturing the bottle the stopper, with the cap and valve, are made separate from the neck, in which the stopper is cemented after the bottle is filled. The construction effectively prevents refilling a bottle after it has once been emptied.

CLOTHES LINE CONVEYER.—Alexander G. Molteni, Hoboken, N. J. This invention relates to sheaves or pulleys to be attached to a window frame, etc., by which a clothes line may be drawn in and out, to hang out or take in the clothes, and provides a pulley frame which may be clamped or secured at any desired angle, and which can be cheaply made. Bridge pieces prevent the line from slipping off the sheave or pulley, and the device may be used either side up, bringing the handle on the right or the left hand side.

SPONGE GATHERER.—John Peacon, Key West, Fla. A novel grappling device has been devised by this inventor, having a metal frame adapted to rest on the sea bottom, a cross bar with eyes on the top of the frame, two bails hinged to the frame and having inwardly projecting tines, while ropes passing through the eyes of the cross bar are attached to the bails. The device is designed to facilitate the gathering of sponges in deep water, where the ordinary pole with grappling hooks cannot be used. It is operated by two ropes, the slacking of one of which, when the grappling device is on the bottom, allows the bails with their tines to engage the sponge, when the grapple with its sponge may be drawn up by the other rope.

ROPE OR CLOTHES LINE TIE.—Louis Keller, Brooklyn, N. Y. To facilitate fastening the loose end of a rope, cable or clothes line in place, or automatically releasing it when desired, this inventor has devised a casing having means of attaching one end of a rope and a guide for the other or loose end, while a horn pivoted on the casing is adapted to receive and hold the loop formed by the loose end of the rope. There is a locking and releasing device for the horn to hold it in a locked position on the casing or release it to throw off the loop.

CORSET COVER.—Max Galland, Wilkesbarre, Pa. This cover has a back with forwardly extending side flaps arranged to be fastened together at the front to form a low cut waist, while a loose front has a shoulder connection with the back, and forms with the latter arm holes, the front being held in place by the side flaps. The cover readily adjusts itself to the form of the wearer's body or corset, insuring a perfect fitting, and at the same time giving entire freedom to the arms of the wearer.

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References to former articles or answers should give date of paper and page or number of question.

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(7159) B. G. M. asks: 1. How much current is required in nickel plating through 30 gallon solution with anodes hung 8 inches from articles to be plated? A. It depends on the area which is to receive the deposit. On copper allow 0·4 to 0·8 ampere per 15½ square inches. For copper on zinc use 1·3 to 15 amperes. The first deposit should be given with a strong current; then follow with a lighter current. 2. In nickel-plating cast iron what is used to fill the blow holes to make an even surface to plate on? A. Lead may be used. It is a good plan to have the article galvanized before nickeling and to give that a thin copper coating. The zinc will fill up small holes.

(7160) J. W. W. writes: What is the greatest amount of electro-motive force that has ever been successfully used in a telephone? A. In a Bell telephone the E.M.F. may be quite high momentarily, but there is no record of it that we know of. In condenser telephones it may be very high.

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

MAY 4, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Can. See Jacketed can. Key opening can.
Canopy for vehicles, etc., Buchanan & Tisdal 581,691
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Capsule, wafer, K. Morstadt 582,021
Car and air brake coupling, combined, J. B. Thomas 581,890, 581,891
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Car coupling, C. F. Flowers 581,906
Car coupling, J. F. Harris, Jr 582,058
Car coupling, J. W. T. Riley 582,147
Car coupling, Ward & Richar 581,895
Car fender, street, D. Leib 581,741
Car roof, J. L. Honhorst 582,160
Card clothing attaching device, Mills & Hunton 581,752
Card clothing, machine for attaching clips to, C. Mills 581,751
Card clothing, machine for making flat fastening clips for, Mills & Penney 581,753
Card clothing preparing device, C. Mills 581,748
Card clothing to flats, device for attaching, C. Mills 581,749
Card clothing to flats, machine for fastening, C. Mills 581,750
Cartridge loading implement, E. O. Carvin 581,847
Case. See Toilet case. Tool case.
Cash register, J. W. Rehill 581,771
Catalogue card assorting device, W. L. Boyden 582,035
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Cattle guard, J. D. Sullivan 582 002
Cement, hydraulic, R. W. Lesley 582,068
Cereals, degerminating, J. F. & R. T. Gent 581,908
Chain and chain link, R. A. Breul 581,844
Chain and wheel, sprocket, J. A. Brown 581,689
Chain guard, dust proof, J. Salisbury 582,099
Chain, sprocket, A. T. Dowden 581,852
Chain, sprocket, J. C. Hauger 581,988
Chair. See Dental chair. Folding chair. Reclining chair.
Chair fan attachment, rocking, E. Davey 581,902
Checkrein attachment, E. A. Sweet 582,003
Checkrein holder, C. H. Scheermesser 582,134
Check row wire, P. Baxendale 581,805
Cheese safe, H. E. Beerling 582,005
Chopper. See Cotton chopper.
Christmas tree candle holder, A. W. Hoffmann 581,725
Chuck, screw cutting, S. C. Hills 581,990
Churn, W. C. Blundell 581,687
Churn, C. H. Linney 581,742
Churn, J. P. Rogers 582,095
Cigar attachment, H. De Haas 581,849
Cigar lighter, electric, H. M. Handshy 581,718
Cigar machine, J. Bunn 581,692
Clip. See Bell clip. Paper clip.
Clothes drier, H. E. Buck 581,931
Clothes pounder, W. Swenson 581,964
Clothes rack, W. C. Baker 582,152
Coating with tin, lead, or other metals, etc., apparatus for, H. F. Taylor 581,791
Cock for air brake pipes, angle, M. C. Glenn 582,053
Coffee mill, H. Kalmbach 581,729
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Copper from its ores, extracting, G. W. Goetz 581,910
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Coupling. See Bicycle coupling. Car coupling. Car and air brake coupling. Ladder coupling. Pipe coupling. Rod coupling.
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Current motor, submerged, J. J. Smith 582,000
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Display rack, hat, R. Szczys 582,004
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Doweling jig, J. Coyle 581,811
Drier. See Clothes drier. Grain drier.
Drying apparatus, yarn, C. G. V. Sjostrom 581,948
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Electric circuit switch, A. J. Wurts 582,111
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Electric motors, method of and means for controlling, H. P. Davis 582,115
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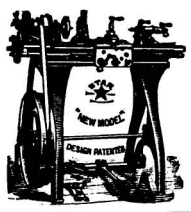

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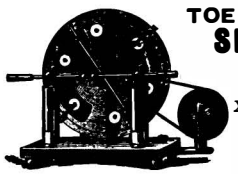

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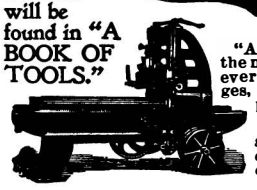

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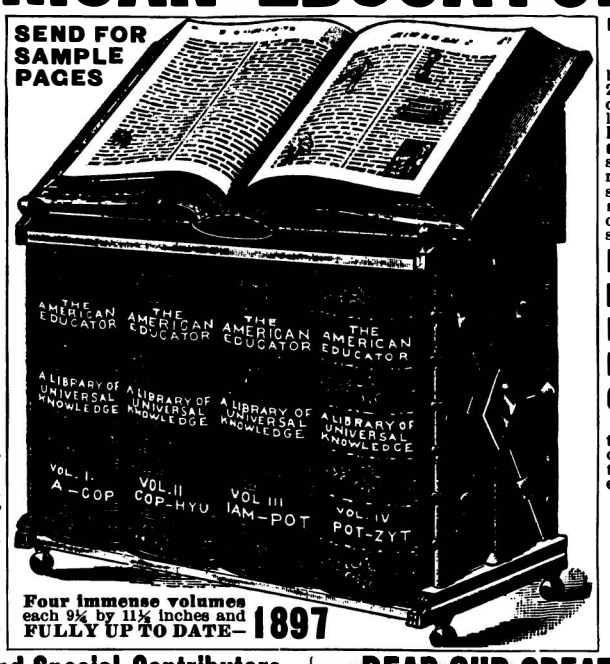

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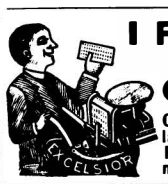

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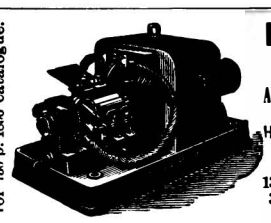

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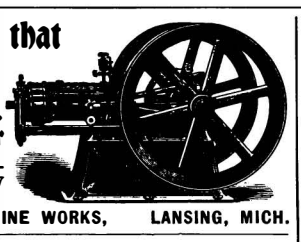

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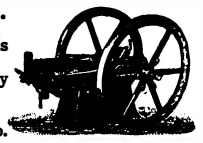

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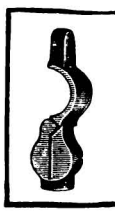

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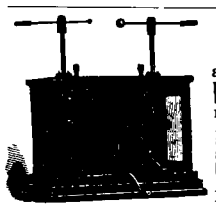

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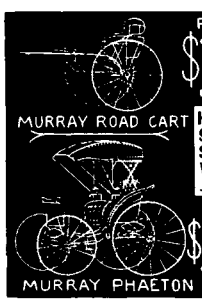

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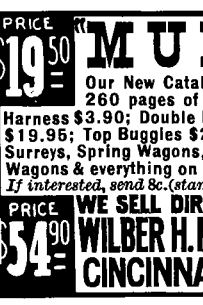

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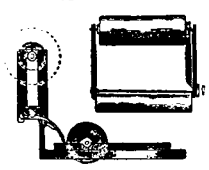

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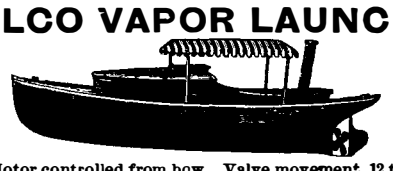

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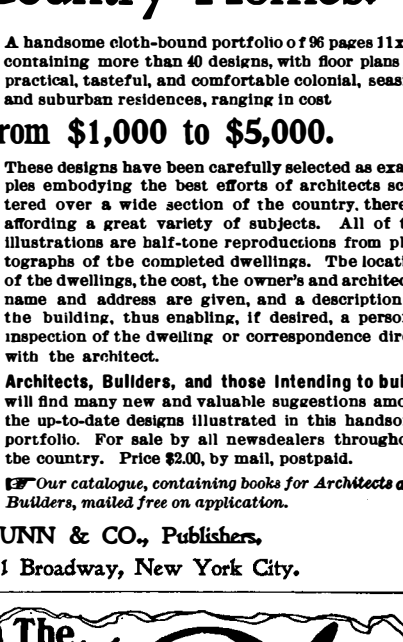

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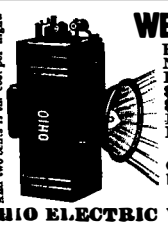

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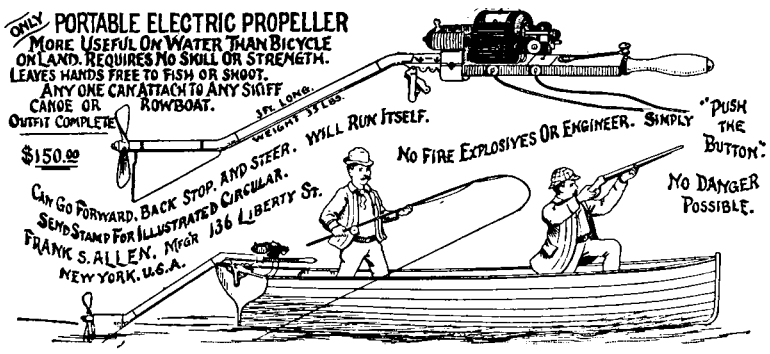
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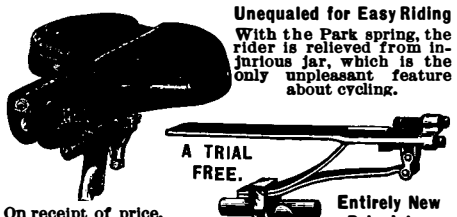

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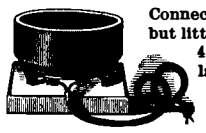

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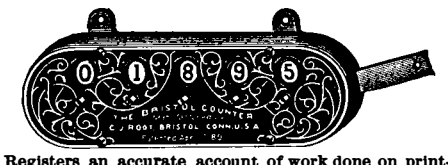

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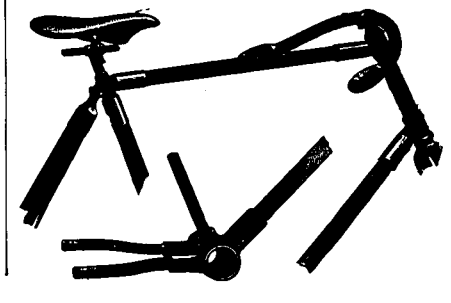

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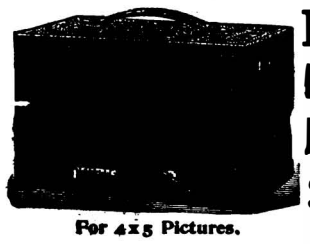

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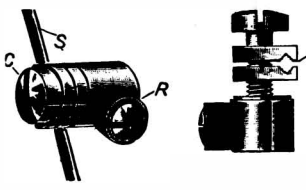

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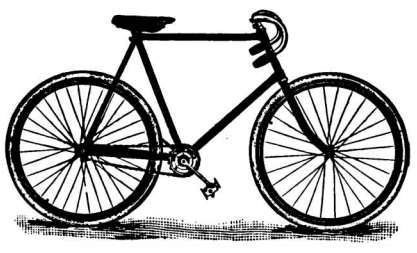

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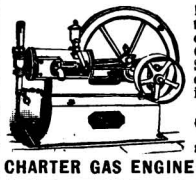

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